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TRW

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Advanced X-ray Astrophysics Facility

Quality Assurance Plan

Submitted to:
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Submitted by:
TRW Space & Technology Group
One Space Park
Redondo Beach, CA 90278

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Advanced X-ray Astrophysics Facility

Quality Assurance Plan

Prepared by:

R.J. Stonick
Project Quality Manager

Approved by:

J.C. Grant
Project Quality Assurance Manager

Approved by:

J. A. Nisenbaum
Product Assurance Manager

Approved by:

E.G. Wheeler
AXAF Program Manager

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ACRONYMS

AIPS	Automated Inspection Planning System
ATD	Applied Technology Division
A&T	Assembly and Test
ADCS	Automatic Data Collection System
AXAF	Advanced X-ray Astrophysics Facility
CAB	Corrective Action Board
CACC	Corrective Action Control Center
CACR	Corrective Action Contact Request
CADM	Configuration and Data Management
CASE	Coordinated Aerospace Supplier Evaluation
CAR	Corrective Action Request
CCB	Configuration Control Board
CDR	Critical Design Review
CEI	Contract End Item
CIS	Contract Inventory System
CMM	Configuration Management Manual
CTE	Custodial Test Equipment
DOD	Department of Defense
DPRO	Defense Plant Representative Office
DR	Discrepancy Report
EEE	Electrical, Electronic and Electromechanical
EGSE	Electrical Ground Support Equipment
EKC	Eastman Kodak Corporation
EMC	Equipment Management Center
EO	Engineering Orders
EPR	Equipment Performance Report
FIPP	Fabrication/Inspection Process Procedures
FRB	Failure Review Board
GOE	Ground Operating Equipment
GFP	Government Furnished Property
GSE	Ground Support Equipment
GSI	Government Source Inspection
HDOS	Hughes Danbury Optical Systems
HQAM	Hardware Quality Assurance Manual
KSC	Kennedy Space Center
M&TE	Measuring and Test Equipment
MGI	Mandatory Government Inspections
MGSE	Mechanical Ground Support Equipment
MIL	Military
MR	Material Review
MRB	Material Review Board
MStd	Measurement Standard
MSys	Measurement System
MSFC	Marshall Space Flight Center
MSO	Manufacturing Shop Orders
NASA	National Aeronautics and Space Administration
NDE	Non-Destructive Evaluation
NMR	Nonconforming Material Reports
PAL	Parts Accumulation List
PAM	Product Assurance Manager
PAMPL	Project Approved Materials & Processes List
PAPL	Project Approved Parts List

ACRONYMS (CONTINUED)

PAR	Product Assurance Requirements
PCIS	Product Configuration Information System
PDR	Procurement Discrepancy Report
PIN	Part Identification Number
PM&P	Parts, Materials and Processes/Plan Methods and Processes
PMA	Property Movement Authorization
PO	Purchase Order
PQ	Procurement Quality
PQM	Project Quality Manager
PQP	Project Quality Plan
PR	Preliminary Review/Process Requirements
PRR	Parts Replacement Requisition/Production Readiness Review
PS	Procurement System/Procurement Sources
QA	Quality Assurance
QAP	Quality Assurance Plan
QASD	Quality Assurance Supplier Directory
QD	Quality Directives
QPII	Quality Planning Inspection Instructions
QPR	Quality Project Requirements
R&O	Routing and Operations
RAR	Reliability Action Requirement
RFP	Request For Proposal
SOA	State-of-the-Art
SE	Support Equipment
SIR	Supplier Information Requests
SOW	Statement of Work
SQD	Supplier Quality Data
SQDS	Supplier Quality Data System
SRIIP	Supplier Rating Improvement Incentive Program
SRP	Standard Repair Procedure
SRR	Scrap, Rework, Repair
SSIS	Standard Stock Inventory System
SSPL	Standard Special Processes List
S&TG	Space and Technology Group
TBD	To be determined
TC	Trace Control
TCN	Trace Control Number
TDR	Test Discrepancy Reports
W/T	Withhold Tag

1.0 INTRODUCTION

1.1 SCOPE

The top level contract document for Quality Requirements on the AXAF Program is NHB 5300.4(1D-2). The AXAF Quality Assurance Plan sets forth TRW's plan for implementation of these contract requirements. In case of any inconsistency between this plan, TRW documents and NHB 5300.4(1D-2), the NHB document shall prevail. The Software Quality Assurance Plan will be incorporated into the Software Management Plan DR DM01.

TRW will utilize to the extent possible their internal standard practices to meet the NHB 5300.4(1D-2) requirements. TRW standard practices are established and documented in the Hardware Quality Assurance Manual (HQAM). Where standard practices do not meet the NHB document, special requirements documentation for AXAF will be issued and implemented through AXAF Quality Project Requirements (QPR). Area standards specific to manufacturing of electronic boxes, manufacturing and test of propulsion hardware, procurement quality, and spacecraft assembly and test are implemented through Divisional Quality Directives.

At the beginning of each section of this plan, the applicable sections of the HQAM are identified. The number in parenthesis following each major paragraph heading of this document identifies the corresponding requirement of NHB 5300.4(1D-2). Appendix A shows the relationship of NHB 5300.4(1D-2) to the TRW Hardware Quality Assurance Manual.

The TRW AXAF Project Quality Manager will provide the focal point between the NASA activity and TRW's selected suppliers and subcontractors for the Quality Assurance activity on AXAF. All documentation, approvals/disapprovals, requests for information etc. relative to the Quality Assurance activity will be made through and provided by the TRW AXAF Project Quality Manager.

1.2 GENERAL

The following tasks outline the overall quality assurance plan by TRW to ensure all quality assurance related contractual requirements for AXAF are met.

- Establish a QA organization which provides technical support in the areas of:
  - Subcontract quality
  - Design Quality criteria
  - Procurement Quality
  - Manufacturing Quality (electronic box level)

- Assembly and Test Quality (spacecraft level)
- Launch site/flight operations QA
- Software QA

o Assure by issuance of QPR's, Quality Bulletins, PARs, POs, etc. the flowdown of Government/contractual requirements for Quality Assurance to:

- Subcontractor/supplier activity
- In-house activities

o Establish a quality records information database/system encompassing:

- Requirement flowdown documents
- Audit reports and corrective action
- Subcontract QA records
- Cost of quality/scrap, rework, repair data
- End-Item data packages (equipment log books)
- As-built configuration and traceability records
- Nonconformances/resolution
- Test records
- Test failure data
- Photographic closeout records
- Incidents/overstress analysis
- Supplier Information Requests
- Qualification by similarity data
- Waiver/deviation
- Log of temporary installation hardware installed/removed

o Provide technical support to:

- Major milestone reviews (PRR, PDR, CDR, etc.)
- Review subcontract and procurement documentation to ensure incorporation of Quality Assurance requirements

- Survey in-house documentation (specification, procedures, drawings, etc.) to ensure incorporation of QA requirements
- Assure implementation of the Critical Item Control Plan
- Assure compliance to the Contamination control plan release

o Establish requirements for receiving inspection of components, piece parts and materials.

o Provide in-line inspection during the manufacturing, assembly and test process to verify:

- Drawing, Specification and Procedure Requirements
- Compliance with TRW policies/procedures

o Validate requirements verification through:

- Assembly and control of End-Item Data Packages
- Surveillance and control of test process
- The as-built configuration documentation

o Audit subcontractors for implementation of AXAF quality requirements.

o Provide technical support during the launch operation to monitor and report on:

- Control of non-flight hardware and tools on the work stand or near the AXAF
- Compliance with appropriate handling, transportation, and shipping procedures
- Compliance with launch site repair/replacement procedures
- Adherence to AXAF approved launch procedures
- Compliance to contamination control plan
- Compliance with Electrostatic Discharge requirements
- Compliance to environmental control requirements

The controls described in this document are applicable to the following categories of hardware and test as follows:

a. Flight and Qualification Hardware: All of the controls described in this plan are applicable to this classification of hardware.

b. Deliverable GSE: A set of Quality Project Requirements documents is prepared which describe, in detail, the specific controls that apply to deliverable EGSE and MGSE. The criticality, interface with the AXAF, and use of each piece of MGSE dictates the quality provisions applied to each individual piece of equipment.

c. Ground Operating Equipment: GOE, such as the GSE, has Quality Projects Requirements documents which dictate the specific controls that apply to that equipment The QPR enforces controls that are commensurate with the end use of the hardware.

d. System Test and Environmental Test: System level, as well as unit level performance requirements are defined by specifications. The test conduct and environmental exposure is detailed by approved and controlled test procedures.

e. Software Quality Assurance: The TRW Quality organization will provide assurance that computer software programs developed for flight, ground and ground test of AXAF flight equipment are developed and controlled in accordance with established procedures. The assurance function during the development phase is a progressive audit by Software Quality Assurance of software design reviews, unit development folders, and compliance with AXAF programming standards. Details can be found in the Software Quality Assurance Plan.

f. Remote Sites: The same quality system disciplines applicable at TRW Redondo Beach are applicable to TRW operations at Huntsville and the Eastern Launch Site.

Revisions to this quality assurance plan will be prepared by the Project Quality Manager (PQM) as necessary. Submittal to MSFC for review and approval will follow approvals by the AXAF Product Assurance Manager and the AXAF Program Manager.

1.3 RELATION TO OTHER CONTRACT REQUIREMENTS

The AXAF product assurance requirements for reliability, manufacturing, maintainability test verification, safety and configuration management have been reviewed to preclude duplication of tasks between quality assurance and other disciplines. At interfaces where overlapping may occur, coordination with the appropriate organization will take place to eliminate duplication of effort.

1.4 SURVEILLANCE OF THE CONTRACTOR

The activities of the quality assurance program are subject to continuous surveillance by MSFC and designated quality assurance representatives. Specific mandatory government inspections (MGI's) will be documented in a Quality Project Requirement (QPR) document upon receipt of detailed requirements. Documents,

records, equipment, facilities, and assistance will be provided to MSFC and DPRO representatives for performance of their duties.

1.5 QUALITY PROGRAM DOCUMENTS

The types of quality documents to be used on AXAF include the following:

a. Quality Directives (QDs)

QDs, published in quality directive manuals, provide detailed procedural instructions for QA system requirements peculiar to a group's divisions or other major organizations. QDs are numbered in accordance with group requirements, with prefixes to identify unique areas. Changes to QDs or unit instructions are by bulletins or by revision.

b. Workmanship Standards Manual

The TRW Workmanship Standards Manual establishes workmanship criteria to be used for end item inspection of Hi-reliability spacecraft or electronic hardware manufactured by the Manufacturing Division. The manual is applicable within the Manufacturing Division unless superseded by program contract requirements, engineering specifications, drawings or Fabrication/Inspection Process Procedures (FIPPs). This workmanship criteria is available for use by other TRW divisions as specified in project or other directives. Changes or additions to the Workmanship Manual are by revision and released through CADM.

c. Quality Planning Inspection Instructions (QPIIs)

QPIIs define technical inspection criteria or detailed instructions pertaining to particular items or to groups of similar items, or to processes. QPIIs are numbered in accordance with group instructions. Changes to QPIIs are by revision.

d. Fabrication/Inspection Process Procedures (FIPPs)

Each FIPP contains detailed instructions for performing a manufacturing process and the inspection instructions and acceptance criteria for that process. The QA section of a FIPP performs the function of a QPII.

e. Project-Related Documents

1) Quality Assurance Plan (QAP) describes the methods by which AXAF will implement contractual quality program requirements.

2) Project procedures describe contract or project-unique implementing procedures for performing project quality program tasks.

3) Quality Project Requirements (QPRs) describe project-unique quality requirements for TRW performer divisions.

4) Product Assurance Requirements (PARs) describe quality requirements for supplier/subcontractor/subsidiary procurements.

5) Project Quality Assurance will maintain and monitor the critical process procedures list to ensure that any process changes have customer approval.

QA system documents are controlled and released through appropriate organizations, typically Configuration Administration and Data Management (CADM). Project-unique documents such as a QAP or a PAR document are released through the Program Office.

1.6 APPLICABLE DOCUMENTS

The following documents are applicable as referenced herein:

Government

NHB 5300.4(1D-2)	Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program
NHB 5300.4(1C)	Inspection System Provisions for Aeronautical and Space System Materials, Parts, Components and Services
MIL-STD-45662	Calibration System Requirements
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-414	Sampling Procedures and Tables for Inspection by Variables for Percent Defective
PA05	AXAF Reliability Plan
SE04	Materials and Processes Plan
SA03	AXAF Safety Plan
DM01	AXAF Software Management Plan
PA07	AXAF EEE Parts Control Plan
CM01	AXAF Configuration Management Plan

MIL-I-45208A	Inspection System Requirements
TRW	
DO1443	Shelf Life Control Document
D08935	Electrostatic Discharge Control Program for Protection of Electronic Parts and Assemblies
HQAM	TRW Hardware Quality Assurance Manual
PAR700-272	AXAF Product Assurance Requirements for Subcontractors
PAR700-303	AXAF Product Assurance Requirements for Subcontractor Mirror Elements
D03464	Standard Special Processes List (SSPL)

2.0 MANAGEMENT AND PLANNING (500)

2.1 ORGANIZATION (500.2)

The AXAF quality assurance program is organized for the effective implementation of NHB 5300.4(1D-2) requirements. Successful application of this plan is ensured by the following:

a. A quality assurance organization centralized under the direction of a Project Quality Manager (PQM) who reports directly to the AXAF Product Assurance Manager (PAM).

b. Technical specialists for both subcontract and in-house manufacturing, Assembly and Test QA. They implement the policies, coordinate and direct the activities and perform the tasks necessary to comply with the requirements of the program.

c. The AXAF Product Assurance Manager (PAM) acting as a single point of contact between the AXAF program and the various quality assurance functional organizations within TRW. These organizations provide the necessary resources (personnel and facilities) to perform the QA tasks. The AXAF PAM controls these resources through budget authority, as flowed down from the AXAF Program Manager.

d. The AXAF PAM acting as a single point of contact with the MSFC S&MA office on matters related to AXAF QA.

e. A flowdown of QA requirements to subcontractors through the Subcontractor Product Assurance Requirements documents (PAR700-272 and PAR700-303).

The AXAF PAM's role is to have responsibility and authority for directing and managing the quality activities for AXAF. He reports directly to the AXAF Program Manager. This allows a direct line of communications to top level program management on issues related to QA.

The AXAF PAM reports, independently, to the Director of Quality for the Space and Technology Group at TRW (Ref. Figure 1). Direct communication is, therefore, available to senior functional management including the Group Vice-President.

The AXAF Project Quality Manager is a quality specialist who plans and coordinates the day to day implementation of activities necessary to comply with NHB 5300.4(1D-2). In this capacity, he will direct both in-house manufacturing QA, Assembly and Test QA, and subcontractor QA. A summary of his activities include:

- QA planning
- Requirements definition, dissemination and implementation
- Quality assessment

- Training
- Audits
- QPR preparation

Specific areas for the applications of quality assurance control include:

- Hardware and material traceability
- Procurement QA
- Manufacturing QA
- Assembly and Test QA
- Nonconforming hardware/materials control, reporting and correction
- Metrology
- Stamp control
- Handling, storage and shipping control
- Mission Operation QA
- Software QA

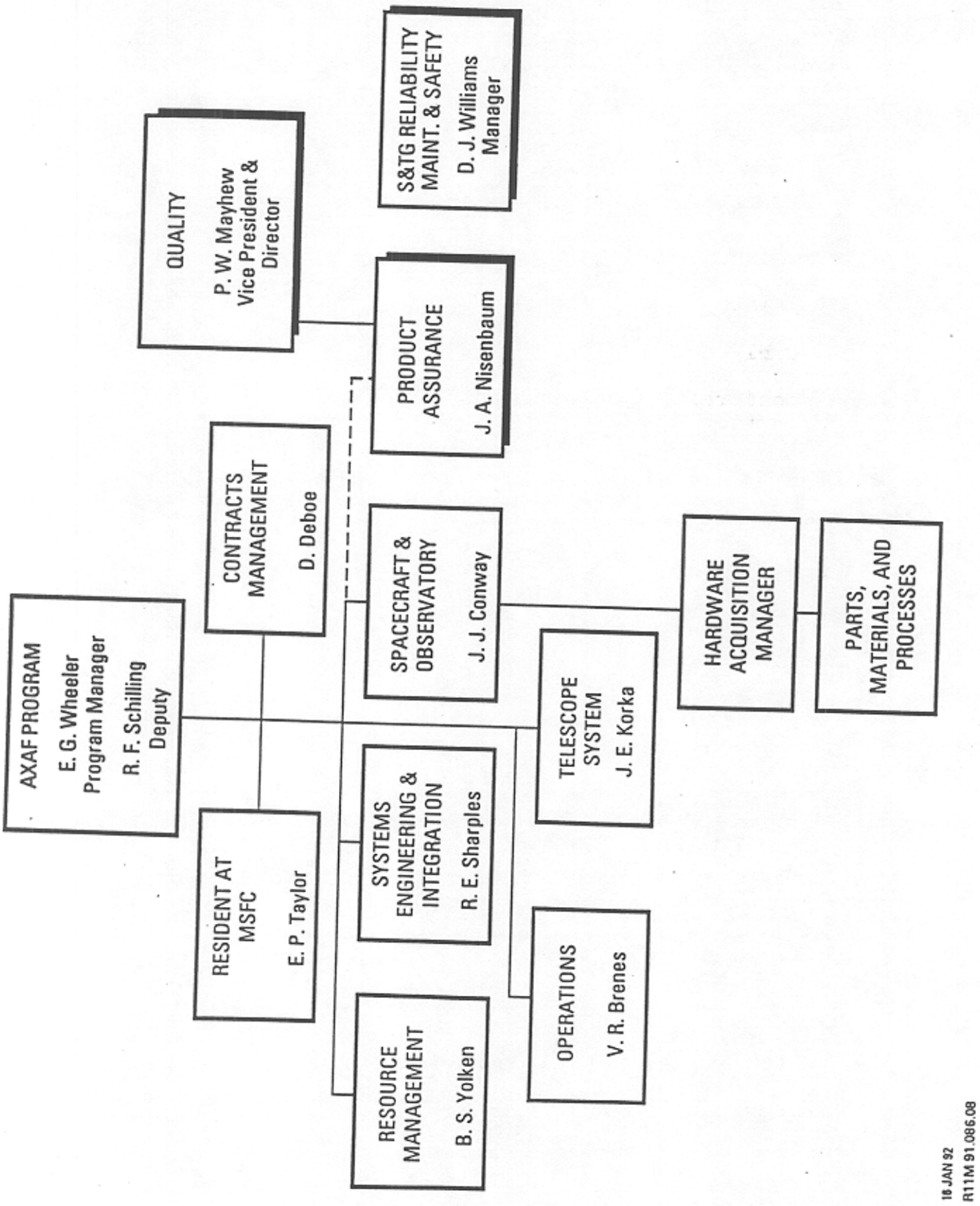

Figure 1. AXAF-I Program Organization

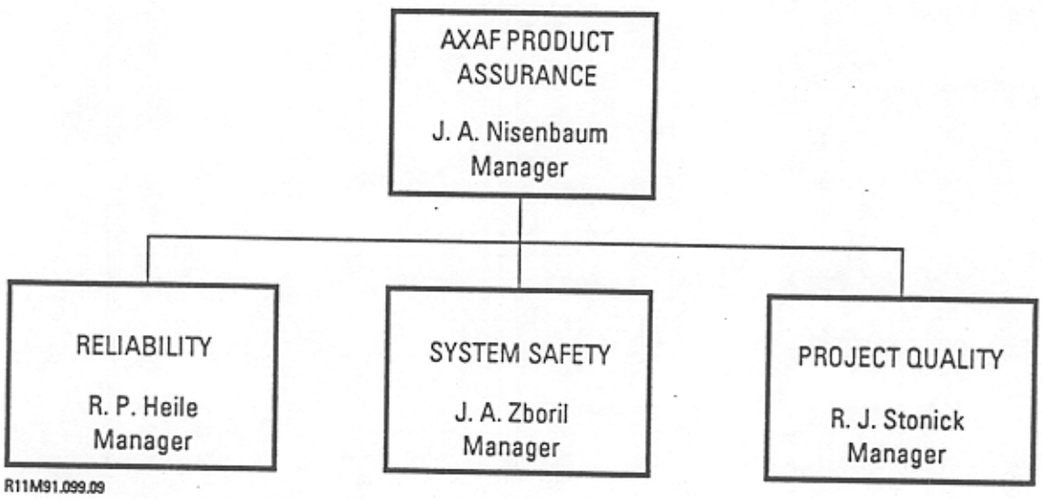

Figure 2. AXAF-I Product Assurance Organization Chart

2.2 PLANNING (500.1)

Quality assurance program planning at TRW begins with participation by quality assurance personnel in the review and generation of inputs to the initial program proposal. Quality assurance controls are established for each type and model of hardware in accordance with the TRW Hardware Quality Assurance Manual system of documents for Quality Assurance Products and Services. After receipt of the contract, special contract requirements are defined, and manpower and costs are allocated for the various quality assurance tasks. These tasks encompass procurement, engineering design, development, fabrication, processing, assembly, inspection, test, checkout, packaging, shipping, storage, maintenance, field use, flight preparation, and launch operations. Objective evidence of quality conformance, including records of inspection and test results, will be readily available to MSFC and designated representatives. Project quality element work tasks, milestones, and schedules are developed and maintained.

To ensure a successful program, TRW has developed the AXAF quality assurance plan which:

- Emphasizes special attention to fabrication and inspection requirements
- Assures a thorough test surveillance program
- Supports the comprehensive design and hardware review program
- Monitors subcontractors to ensure consistency of the overall quality assurance effort
- Assures implementation of appropriate control procedures on critical/special attention items
- Supports a comprehensive failure reporting system to assure positive problem management.

The Quality Assurance organization and responsibilities for the AXAF project have been established. Quality Assurance participates through all phases of the project from design to launch operations. The quality program is designed to provide prompt detection of problem areas and to facilitate timely and positive problem management.

2.3 QUALITY CONTROLS (500.4)

SUBCONTRACTOR CONTROL

The AXAF Product Assurance Requirements (PAR) documents for subcontractors flows down all pertinent PA requirements. The PAR document with the subcontractor Statement of Work become contractual documents to each AXAF subcontractor.

Authorization for the use of specific subcontractors facilities is based on the verification that those facilities meet the QA requirements of NHB5300.4(1D-2) prior to the award of a subcontract. After contract award, compliance with these requirements is audited on a yearly basis or as needed by a technical QA specialist.

Nonconformance at the subcontractors is handled either by the TRW MRB or through delegation of MRB authority to the subcontractor.

IN-HOUSE CONTROL

The in-house QA effort is controlled through the preparation and use of Quality flow down Project Requirements documents (QPR). These documents flowdown specific, program unique requirements to the performing divisions within TRW. Cross reference is made to specific TRW Quality policies, as documented in the Hardware Quality Assurance Manual and Quality Directives.

2.4 NONDESTRUCTIVE EVALUATION (500.5)

Non-destructive evaluation (NDE) techniques are an integral part of the AXAF verification process. TRW utilizes these techniques in areas associated with fracture control, voids in honeycomb structure, weldments, semi-rigid cables and selected piece part evaluation to name a few. Accept/Reject criteria for NDE methods are established through notes on engineering drawings or sections of critical process specifications.

TRW maintains its current application of NDE through certification (i.e., certified by Rockwell to NASA fracture control requirements) and government and industry interchange.

As part of the design process, TRW QA interacts with the responsible design engineers to ensure inspectability of designs using state-of-the-art NDE.

2.5 MANAGEMENT ASSESSMENT DATA (500.6)

The existing TRW QA system of documents, forms and computerized quality data provides the necessary tools for the collection, processing analysis, storage and dissemination of quality information and trend analysis throughout all program phases. Two basic computer systems are utilized by TRW to record data on scrap, rework, repair (SRR) and quality costs. Automatic Data Collection System (ADCS) collects all labor charges against Manufacturing Shop Orders (MSO) by category of labor expended (types of work being performed on a specific MSO). These data can be summarized to functional departments. The Contract Inventory System tracks the Stockroom Status of Parts and Materials. The baseline SRR and quality cost data are available through these two systems. This data for Quality cost and SRR are reported at the program and group levels respectively which provides accomplishments, problems encountered, and subcontractor activities.

2.6 TRAINING (500.7)

Quality Program Audits are performed in accordance with the yearly TRW S&TG Compliance Review Plan. These compliance reviews are performed by key management personnel active in each specialized function of Electrostatic Discharge Control, Reliability, System Safety, Software QA, Project Management, Spacecraft QA and ATD QA. There are four (4) types of reviews defined as follows:

1. TRW independent compliance reviews
2. TRW reviews with DPRO participation
3. DPRO reviews with TRW participation
4. Joint TRW/DPRO reviews

Personnel will be instructed as necessary in the requirements of the AXAF Program, the importance of their functions in relation to the total project, the need for sustained high quality, and the methods and procedures to be followed for particular jobs including safety and housekeeping.

2.6.1 Certification and Re-Certification of Personnel

TRW maintains formal training and certification programs for selected processes and operations which are critical to the quality and integrity of the end product. Requirements for special training and skill level certification are derived from specifications imposed by engineering drawings, from specific contract requirements, process specifications and by management decision in response to specific problems.

The certification process includes satisfactory completion of a written examination or performance demonstration that is approved by NASA or its designated representatives. The maximum certification period is one year. However, the training schedule may specify more frequent recertification. A 30-day recertification grace period is allowed after expiration.

Quality assurance and manufacturing supervision evaluate skill performance and if employee workmanship deteriorates as determined from Nonconformance Reports, arrangements are made for retraining and recertification.

2.6.2 Records

Certification and recertification are based upon examination of performance and certification cards issued. Records of personnel certification, including complete process identification and certification, are maintained.

2.7 QUALITY PROGRAM AUDITS (500.8)

The formal compliance review program is conducted with the area supervisor on a monthly and random basis using formal checklists and monitors the activities of supporting organizational elements

that influence product quality. These audits are performed to evaluate the effectiveness of company policy implementation, to measure effectiveness of quality systems and personnel, to identify potential problems, to assure the fulfillment of project requirements, including safety and housekeeping controls, and to improve cost-effectiveness. The schedule of these audits are specified in the S&TG Compliance Review Plan.

In addition to the compliance review program, special investigative audits are conducted by project quality management in response to specific program problems. The findings of all audits are reported to management and maintained on file for reference and corrective action follow-up.

Random, unscheduled audits are performed by the functional Quality Assurance organizations to fully assess the effectiveness of the in-place system and apply fully to subcontractors as well as in-house activities.

2.7.1 Planning

Plans for audits are prepared by the applicable Quality Assurance organizations. Quarterly review of the audit (review) process is conducted by the Compliance Review Steering Committee chaired by the director of Quality. Criteria which are considered in selecting the specific audits in each plan include:

a. Past performance of the organization to be audited.

b. Time since the last audit.

c. Changes in operations or organization since the last audit.

d. Expected value of the audit to improve operations.

e. Criticality of the operation.

f. Problem indications obtained from any source (e.g. trend data, customer deficiency reports, etc.).

g. Joint reviews are conducted with DPRO, and they are invited to join TRW on our regularly scheduled reviews.

2.7.2 Conduct of Audits

Before performing an audit, the auditor meets with the manager of the activity to be audited. Results of the meeting may be used to refine the audit task plan. The manager is invited to participate in the audit.

Audits are conducted in accordance with the S&TG Compliance Review Plan. Less complex audits are generally conducted to checklists. Where appropriate, operating procedures of division organizations may be referred to as the standard against which these organizations are audited.

Upon audit completion, the auditor reviews the findings and the recommendations with each responsible manager. Non-compliance conditions are reported immediately so prompt action may be taken.

2.7.3 Corrective Action

Corrective actions will be identified and implemented by the responsible project managers. Each corrective action is administratively controlled by closure to the extent warranted by the identified problem.

2.7.4 Audit Reports

Reports of audit results/corrective actions are promptly issued to the applicable project. Audit reports may be presented to TRW Corrective Action Boards (CABs) and/or project review authorities. High impact findings will be highlighted for follow-up by the responsible CAB. Audit findings will be available for MSFC and DPRO review.

2.7.5 Data System

Each group Quality organization has a data system to maintain audit reports and corrective actions to facilitate the retrieval and analysis of audit data.

3.0 DESIGN AND DEVELOPMENT CONTROLS (501)

Ref. HQAM 0.3, 1.1, 3.0, 4.2, 4.4, 13.1, CMM 2.7-2.9

3.1 TECHNICAL DOCUMENTS (501.1)

The AXAF QA organization establishes design control requirements and quality criteria through a set of detailed quality documentation. This documentation, covers both procured and in-house activities.

Procured Activities

- Product Assurance Requirements Documents for Subcontractors, (PAR700-272 and PAR700-303).
- Quality Project Requirements for Suppliers

In-House Activities

- Quality Directives
- Workmanship Standard Manual
- Quality Project Requirements
- Fabrication/Inspection Process Procedures

Development of quality inspection and test surveillance planning is generated and documented by Quality Planning Inspection Instructions.

Review of technical documents include:

- CEI Specifications
- Equipment Specifications
- Procedures
- Procurement Packages

3.2 DESIGN REVIEW SUPPORT (501.2)

TRW does not limit quality activities to quality assurance personnel solely. The following technical specialties participate at design reviews to verify implementation of quality design criteria:

- Manufacturing engineering
- Materials and Processes engineering
- Component engineering
- Reliability/maintainability engineering
- Safety engineering
- Quality Assurance engineering

In some instances, checklists are utilized to verify that all quality criteria are included in the design process. In others,

experience of the review personnel is directly applied. In either case, a record of comments, suggestions, recommendations is prepared as official action items. Action items require an assignee and response date. Closure is verified by the appropriate program functions.

The quality activity for AXAF will assure that program documentation implements the appropriate elements of Quality related to identification, inspectability, performance characteristics, and methods for acceptability.

3.3 CHANGE CONTROL (501.3)

Engineering drawings, equipment specifications, formal test procedures, and other engineering documentation requiring formal control are entered into the TRW CADM system for control. The AXAF Configuration Management Plan details the procedures for control of this system.

An AXAF Configuration Control Board (CCB) is established for the program during the design phase. All Class I and Class II changes to the Technical Requirements Baseline, the Design Requirements Baseline, or the Design Release Baseline are subject to CCB action. The AXAF Product Assurance Manager and QA are members of the Board. Specific details of how AXAF change control is managed are defined in the Configuration Management Plan.

TRW maintains a controlled distribution system to the responsible document recipients. All users are on the update distribution and are responsible for removal of obsolete documents. Quality Assurance provides verification of appropriate document usage during surveillance and audits.

Document affectivity is controlled by listing in the planning documents and verification of the as-built versus as-designed configuration data. Quality inspection is responsible for assuring that only CADM controlled engineering drawings and test procedures of the required revision are used.

4.0 IDENTIFICATION AND DATA RETRIEVAL (502)

4.1 GENERAL (502.1)

The TRW system of identification and data retrieval for hardware was developed in conjunction with the engineering documentation, configuration, and logistics management systems. The TRW traceability system assures that parts and materials are identified to procurement, fabrication, and test.

The AXAF Configuration Management Plan defines the numbering system to be used for engineering drawings, specifications, test procedures, list of materials, and drawing changes, as well as the system to be used in the numbering of parts, assemblies, and installations. A series of drawing numbers issued by Configuration Administration and Data Management (CADM) for the identification of AXAF program hardware is provided to the project hardware designers. Physical serialization will be as specified in the AXAF Configuration Management Plan and verified by the applicable quality assurance organization per drawing requirements.

Quality Assurance is responsible for assuring that identification of articles and materials received from suppliers is in accordance with the AXAF serialization requirements. These, as well as in-house manufactured and assembled items are marked and records maintained to provide clear and adequate identification while in stores and throughout subsequent processing operations. Records are retained in quality data centers following delivery of the equipment for the period of time required by the AXAF contract.

4.2 IDENTIFICATION AND DATA RETRIEVAL REQUIREMENTS (502.2)

The TRW procurement, manufacturing, assembly and test, and quality assurance records are designed and maintained so that items from raw stock to completed assemblies can be traced through their identification to their location on the completed AXAF. This identification and traceability is designed and implemented to be traceable both forward and backward. Each separable, inspectable lot of any purchased item is assigned a unique Trace Control Number (TCN) at the time of delivery. Additional TCNs may be assigned if lots are later split for processing or MRB action. The TCN is assigned by the computerized Procurement System. Entry of the TCN in all succeeding inventory and product records provides the forward traceability.

The match up of the traceability requirements stated by the project assigned TC and the traceability data provided is verified at various inspection points, such as, receiving inspection, planning inspection, and parts kit inspection.

Flight Components Traceability provides the following as-built information for each EEE part installed for each flight component:

a. Name of component(s) used in

b. Part number and circuit location (R_1, C_4, Q_2)

c. Manufacturer

d. Date code or lot number

e. Serial number when so marked.

Backward traceability of any part or assembly is initiated by reference to the Product Configuration Information Systems (PCIS) As Built Data Base. The computerized Standard Stock Inventory System (SSIS), Contract Inventory System (CIS), and Supplier Quality Data System (SQDS) are queried, when necessary. Inquiry is made using the PIN, serial number and/or TCN of the item in question. Traceability data consistent with the assigned TCN, such as Serial Number (where applicable), lot date code, manufacturer, purchase order number, quantity accepted/rejected, etc. are available for recall. The referenced documents are then examined for the desired information.

Forward traceability of parts and assemblies is done by inquiry of the combination of the Procurement System (PS), CIS, SSIS, and PCIS using the PIN and/or TCN of the item. The end usage or stores location of individual items and/or lots of parts can be determined. The PCIS data base provides As Designed, As Planned, and As Built information. The CIS and SSIS data bases provide stores receipt and issue information, and the PS data base contains receiving and receiving inspection information. Detail inquiry procedures are contained in the CIS, PS, and PCIS User's Manuals. This scheme of identification and traceability applies to the process used during the manufacturing cycles and to the specific process, mechanical, and electrical tests performed during the AXAF's entire life cycle.

4.3 IDENTIFICATION METHODS (502.3)

The AXAF Configuration Management Plan defines the identification method to be used for control of articles, lot number of articles, and material. The application of data codes, lot numbers, serial numbers and other identification is prescribed in the procurement, manufacturing, and assembly and test documents used to process the contract hardware.

4.4 DOCUMENTATION (502.4)

The Manufacturing Shop Order (MSO) and the Parts Accumulation List (PAL) are the documents that are used during the manufacturing and inspection activity to identify, in conjunction

with the released engineering drawing, parts and processes specifications used in the individual piece of hardware.

The As Built Configuration report is verified by Quality Assurance to assure the latest configuration of hardware is provided from manufacturing to AXAF stores.

Routing and Operations (R&O) sheets are used during Assembly and Test to track hardware in the assembly and test area.

4.5 IDENTIFICATION CONTROL (502.5)

Quality Assurance planning and inspection activities, verifies that the identification methods prescribed in the Configuration Management Plan have been implemented successfully. As stated in 4.2 above, the plan and control provides the capability of tracing backward to the material from which fabrication originated and to determine the location of the like articles or materials within a level of process or assembly.

Manufacturing Planning provides the controls for temporary installation of hardware. This hardware is identified as "placeholders" in the manufacturing cycle and is specified in the planning documents. Use of placeholders is coordinated with the DPRO/Customer during processing and Quality Assurance provides objective evidence of replacement.

TRW Standard Practice for the integration and test operations provides the red tag/green tag procedure for items to be removed prior to launch and items to be installed prior to launch.

4.6 RETENTION AND RETRIEVAL OF RECORDS (502.6,7)

Completed records are sent to various quality data centers for retention and accessibility. Receiving Inspection records are placed in a bonded storage area. Manufacturing records are maintained in the manufacturing data center, and subcontracted items data is maintained with other unit level and assembly and test data in the Quality Records Information database/system. This data is retained for 7 years after contract closeout or as specified in the contract.

Each of these repositories is controlled and maintained so that reasonably quick access is available to all the records.

The same storage and retrieval requirements are levied on subcontractors.

Applicable records will not be destroyed unless authorized by the contracting officer.

5.0 PROCUREMENT (503)

Ref. HQAM 3.1, 3.2, 3.6

5.1 PROCUREMENT CONTROLS (503.1)

The AXAF Quality Assurance organization is responsible for ensuring the overall planning and implementation of quality assurance functions at all procurement sources (PS). These activities are the responsibility of the project quality manager. A list of these activities include:

a. Participate in selection of PS - Project QA provides inputs to the RFPs, reviews proposals, and is a member of the source evaluation board and performs pre-award, post award and maintenance surveys of potential sources to establish their ability to perform to AXAF QA requirements and assess their continuing Quality Systems and staffing capability.

b. Develop quality requirements for PS - QA requirements are developed and flowdown to PS as part of the Product Assurance Requirements for Subcontractor documents. In addition QA tailors applicable quality requirements and flows them down through the S.O.W. for each PS.

c. Review and approve procurement documents - QA is responsible for verifying that procurement packages have been assembled containing all relevant product assurance requirements such as identification and data retrieval, workmanship, certifications, etc. The procurement package is reviewed to assure the inclusion of project technical requirements. QA then presents the package to the MSFC resident or DPRO representative prior to release, when required.

d. Provide technical assistance to PS - If a PS is considered the best choice on technical merit and cost basis but cannot comply with all of the appropriate QA requirements, QA supports the development of the necessary quality systems at that PS to ensure compliance with those requirements. If during a procurement contract, a quality problem is detected, QA supports the PS in investigation, problem identification and resolution.

e. Provide resident/itinerant Quality Assurance Representatives Procurement sources are monitored either by itinerant representatives in the case of minor subcontracts or by a resident where the subcontract is deemed major. Examples of major subcontractors for AXAF are Eastman Kodak Corporation (EKC) and Hughes Danbury Optical Systems (HDOS).

f. Subcontractor/Supplier Source Inspection - Source inspection and surveillance at Subcontractors/Suppliers will be performed when directed in the project procurement quality requirements document. As a minimum the quality representative performs the following:

1. Conducts a continuous planned review of all phases of the approved quality system to assure compliance. If deficiencies are found, the supplier is requested to take corrective action.

2. Assists the supplier in interpretation of safety, reliability, quality, and specification requirements.

3. Conducts progressive "first article" inspection and subsequent planned inspection of components, assemblies, and processes as necessary to determine that the products meet the quality, contractual, and engineering requirements of the purchase order.

4. Participates in scheduled design reviews, verifies incorporation of engineering changes, planning changes, and other configuration change commitments.

5. Verifies test setup, compliance to test plans and procedures, and verifies failure reporting and analysis.

6. Reviews material review (MR) dispositions when the supplier has MR authority; assists the supplier in obtaining materials review action on discrepant articles if the supplier has not been delegated authority.

7. Coordinates reports of unsatisfactory conditions received on the supplier's articles to ascertain that the supplier establishes the cause of such discrepancies and takes prompt and complete corrective action; assures that the corrective action affectivity points are met and maintained to preclude recurrence.

8. Assists the supplier in the implementation of any interchangeability and replaceability program as defined by the purchase order; witnesses the inspection and checks interchangeability verification.

9. Accepts articles approved for shipment and shows evidence of acceptance on the related paperwork.

10. Performs End Item Data Package review for final acceptance and initiates a quality Field Report (QFR) documenting elements of acceptance.

5.2 SELECTION OF CONTRACTOR PROCUREMENT SOURCES (503.2)

Quality Assurance participates in evaluation of proposed suppliers and subcontractors, prior to Purchase Order/Subcontract award, to ensure the adequacy of their quality systems and their ability to meet project quality requirements. This evaluation is based on one or more of the following: review of current supplier quality history with TRW (as verified in the Supplier

Rating Improvement Incentive Program (SRIIP), formal supplier quality preaward surveys, data obtained through the Coordinated Aerospace Suppliers Evaluation (CASE) listing, and/or review of the supplier's quality programs and inspection plans submitted on current in-house spacecraft programs.

Suppliers and subcontractors able to demonstrate to TRW that they meet quality performance requirements, may be used without supplier surveys. Such suppliers and subcontractors must be currently listed in the TRW Quality Assurance Supplier Directory (QASD) and they must continue to demonstrate acceptable quality performance to remain on approved status. When it is not economically feasible to perform a detailed supplier evaluation for small quantity purchases, standard hardware, or off-the-shelf items, purchase orders are awarded only when the quality of the article can be adequately verified in TRW receiving inspection or with source inspection.

When a subcontractor or supplier does not appear on the QASD to NHB5300.4(1D-2) a pre-award survey of his facilities and quality systems is performed by a TRW QA representative. This survey includes comparisons of the subcontractor or supplier with a basic checklist confirming compliance with NHB5300.4(1D-2) or (1C). The specific quality requirements flowdown of these documents shall be determined based upon state of the art hardware development, subcontractors experience, unit cost, and use. The results are documented and retained. A satisfactory rating includes the subcontractor or supplier on the QASD, thus making him eligible for a Purchase Order. Hardware for the AXAF Program will be procured from sources that comply to the requirements of either NHB5300.4(1C) or (1D-2) depending on the significance of the hardware.

Manufacturers of electronic piece parts and selected critical materials are controlled by the Project Approved Parts List (PAPL) and the Project Approved Materials and Processes List (PAMPL). Only Parts and Materials from the approved sources are permitted to be used.

5.3 PROCUREMENT DOCUMENTS (503.3)

Purchase Orders, subcontracts, associated specifications and control drawings initiated for the procurement of articles or services are reviewed by Quality Assurance before release to assure that they meet the following requirements:

a. Subcontractor/supplier is listed in the supplier directory (QASD).

b. Quality Assurance provisions are adequately specified and referenced to the appropriate requirements specified in the Procurement Quality Requirements.

c. Identification of Product Assurance Requirements document PAR700-272, or other AXAF project requirements for suppliers and subcontractors, as appropriate, provide the detailed quality requirements.

d. Verify that the appropriate procurement documents refer to or specify the technical requirements for the procured article.

e. Identification of applicable subcontractor data requirements as deliverables.

Upon satisfactory completion of this review the procurement documentation is presented to the DPRO for approval and designation of GSI.

5.4 CONTRACTOR QUALITY ASSURANCE PERSONNEL AT SOURCE (503.4)

Source inspection and surveillance will be performed when directed in the project procurement quality requirements documents when one or more of the following conditions exist:

a. In-process or end-item controls have such an effect on the quality of the articles that the quality cannot be determined solely by the inspection or tests of the procured articles at TRW.

b. Verification tests are destructive in nature and the quality cannot be verified solely by inspection of tests at TRW.

c. The environments or test equipment required cannot be feasibly and economically reproduced or made available at TRW.

d. Past performance or quality history of the subcontractor or supplier is marginal

e. Qualification testing is to be performed by the subcontractor or supplier.

f. Articles, parts and materials are designated for direct shipment from source to the AXAF Project or using site.

TRW quality representatives will be resident or itinerant at subcontractor and supplier facilities. The proposed staffing policy is to maintain resident inspectors at the major subcontractors and itinerants at the remaining subcontractors.

The TRW quality representative, in conjunction with the suppliers QA personnel performs the following:

a. Reviews of all phases of the approved quality system to assure compliance. Deficiencies require the supplier to take corrective action.

b. Assists the supplier in obtaining interpretation of company reliability/quality, and specification requirements.

c. Monitors basic workmanship inspections prior to close-up.

d. Participates in scheduled design reviews to assure the incorporation of engineering changes, planning changes, and other configuration change commitments.

e. Monitors test setup, compliance to test plans and procedures, and failure reporting and analysis.

f. Reviews Material Review Board (MRB) dispositions when the supplier has MR authority, and assists the supplier in obtaining materials review action on non-conforming articles if the supplier has not been delegated authority.

g. Coordinates reports of non-conformances received on the supplier's articles to ascertain that the supplier establishes the cause of such non-conformances and takes prompt and complete corrective action; assures that the corrective action effectivity points are met and maintained to preclude recurrence.

h. Assists the supplier in the implementation of any interchangeability and replaceability program as defined by the purchase order; witnesses the inspection and checks interchangeability verification.

i. Accepts articles approved for shipment and shows evidence of acceptance on the related paperwork. The supplier is notified of all such articles requiring this operation by the representative.

j. Performs periodic audits of the suppliers quality systems to assure continuing application of that system to the product and manufacturing/quality activity.

k. Works and interfaces with the resident MSFC S&MA representative and/or the delegated Government Inspection Agency representative.

5.5 GOVERNMENT SOURCE INSPECTION (503.5)

The quality project requirements document which identifies AXAF procurement quality requirements is coordinated with and approved by the delegated resident DPRO representative prior to issuing procurement documents. Government source inspection is imposed when requested by the DPRO. Government source inspection does not in any way replace TRW source inspection or relieve TRW of its responsibilities for product reliability, quality, and safety.

5.6 RECEIVING INSPECTION (503.6)

Incoming items are inspected in accordance with preplanned inspection checklists based on appropriate purchase order, drawing, specification requirements and quality clauses specified by the AXAF QPR. Development of inspection checklists considers part-application and characteristics with particular emphasis on those potential defects which may not be detectable during subsequent inspection and test.

Raw materials are properly identified, and composition verification is performed on a sample basis. Physical and chemical analysis certification are reviewed for completeness and compliance to specification requirements. Mechanical items receive inspection with respect to the appropriate drawings or specifications. The exceptions are standard hardware items such as nuts, bolts, screws, and washers, which will be inspected on a MIL-STD-105 sample basis. Electronic and electromechanical parts receive functional tests for specific parameters.

Materials (lots) used in structural applications will be tested to validate specification compliance. Samples of each lot of structural fasteners will be retained for the duration of the contract for possible future analysis.

Screening will be in accordance with the requirements defined in the EEE parts program plan. Semiconductors and other parts requiring high-reliability screening are normally screened at the supplier's facility and shipped with certified test reports.

Complex assemblies, components, or subsystems for which receiving inspection does not have test capability, are normally tested at the supplier's facility and verified by TRW source inspection. When verification tests are required upon receipt, the item is routed to the appropriate test laboratory for the special testing.

Consumables such as gases, chemicals and other process supplies are inspected for proper certification, and labeled to assure proper identification.

Inspection of limited shelf material is performed in accordance with special checklists. Materials with specific temperature and/or storage conditions are identified with a shelf-life material tag attached to each container.

Storeroom surveillance is performed periodically on a random basis for evidence of inspection and test acceptance identification, protection, packaging, handling, storage issuance controls, and general housekeeping cleanliness.

Receiving and inspection test records on supplier materials are maintained in the receiving inspection area and are filed by the procurement document number. The results of such inspections and test are available to customer representatives for review. As

appropriate, acceptance records of purchased assembly items are forwarded to the quality assurance test data center to become part of the data package presented to the test review board.

Discrepant supplies are reported on Procurement Discrepancy Reports (PDRs) and/or Supplier Information Requests (SIRs). TRW assures that suppliers take prompt, remedial, preventive action to preclude recurrence of nonconformances through a Corrective Action Contact Request (CACR) or a formal Corrective Action Request (CAR). These requests are processed through the Procurement Quality Corrective Action Control Center (CACC) for initiation and follow-up. Failure analysis feedback to TRW reliability engineering for failure review board (FRB) closure and reliability analysis input is supported by the TRW quality assurance source representative.

5.7 RECEIVING RECORDS (503.7)

The TRW Procurement Quality organization maintains the history files of receiving inspection data and records. These records reflect the information required to reconstruct the activities that occurred during the receiving inspection cycle as well as selected information developed at the suppliers/subcontractors during their inspection and test activities. The maintained documents include test/inspection results, disposition of the articles/materials, field source reports, and other pertinent data.

5.8 PROCUREMENT SOURCE DATA (503.8)

The TRW Procurement Quality organization maintains the Supplier Quality Data (SQD) system computer data base for receiving inspection data. This data base contains the procurement history of TRW suppliers/subcontractors and is used to evaluate the ongoing capabilities of the procurement sources to aid in the selection of future procurement sources.

5.9 POST-AWARD SURVEY OF PROCUREMENT SOURCE OPERATIONS (503.9)

TRW schedules and conducts post award surveys based on criticality of items being procured, known problems unknown or questionable quality history, and fabrication and test capability. The remaining period of performance will also be taken into consideration. Each survey includes a verification of operations and documentation as well as an examination of produced hardware to verify the effectiveness of the suppliers quality system.

Suppliers quality history evaluations are made on a continuous basis. Problem areas discovered either during the survey or history analysis are documented on appropriate forms and distributed to the supplier for timely correction and prevention of deficiencies. Follow up audits and supplier interface are performed to assure that acceptable corrective actions are implemented.

A schedule of planned surveys for each subcontractor, based upon his contractual schedule of activities, will be prepared and provided to the DPRO and MSFC representatives.

5.10 COORDINATION OF CONTRACTOR PROCUREMENT SOURCE INSPECTION AND TEST

QA will routinely coordinate inspections at suppliers to insure that timing, verification of critical processes and closure of boxes is compatible with the inspection process at the supplier. Additionally, QA reviews and verifies that a similar process is met between our supplier and lower tier suppliers.

6.0 FABRICATION CONTROLS (504)

Ref. HQAM 4.7, 4.8, 5.1-5.5, 12.1-12.5

6.1 FABRICATION OPERATIONS (504.1)

In support of fabrication operations, TRW quality assurance will perform inspections of product hardware as defined below.

As part of the Quality activity Quality Planning reviews the Manufacturing Shop Order (MSO), the Fabrication Inspection Planning Procedure and the detailed Inspection planning and instructions to assure that the product is being built/inspected to the correct criteria and there are sufficient inspection points to assure compliance to drawing requirements.

6.1.1 Quality Assurance Inspection Personnel

o Prior to performing inspection, verify that:

a. Applicable planning has been approved by QA.

b. Prior required operations and inspections have been completed.

c. Nonconforming material reports (NMRs) and test discrepancy reports (TDRs) initiated at prior inspections have been dispositioned, or work to the current inspection point has been authorized in accordance with Section 8 of this plan.

d. Prior required MSFC/DPRO MGIs have been performed and have resulted in acceptance.

o Inspect the product for compliance to the requirements of applicable documents.

For drawings, engineering orders (EOs), and procedures, the revision level most recently recorded by the appropriate release authority is applicable unless an earlier revision level is specified on the approved work instruction for the product being inspected.

o Verify that only specified parts, assemblies and/or materials with evidence of prior acceptance or approved conditional acceptance are used.

o Assure that traceability information is provided as required, and that when limited shelf life materials are used these materials are used within applicable expiration dates.

o Authorize, monitor and document any break of inspection.

- Determine, on completion of rework or repair operations, that damage has not occurred during the operations. Rework or repair is authorized by an approved NMR or by separate planning.

- Notify MSFC/DPRO representatives when items are ready for MGIs.

- Record non-conformances per QD instructions. When NMRs are appropriate, process them in accordance with Section 8 of this plan. Issue NMRs or TDRs as appropriate for nonfunctional discrepancies such as exposure of the hardware to environments which exceed specifications.

- Identify discrepant items with a withhold tag (W/T).

- Document inspection status and results of inspections using inspection status stamps in accordance with Section 10 of this plan.

- Assure that required records are complete and legible, and data are appropriately recorded when specified.

- Enter non-conformance record information into the quality data system. Assure that documentation discrepancies are resolved.

- Verify that equipment used for inspection is as specified, is calibrated or validated as appropriate, and the calibration use interval has not been exceeded. Assure that only measuring and test equipment (MTE) is used to determine compliance to specifications; that MTE or support equipment (SE) labeled

"Inactive" or "Invalid for Use", or equipment with apparent damage or with broken calibration seals, is not used; and that designated procedures are followed in case of need for extension of calibration periods.

- Assure that the certification requirements for special/critical processes are met.

- Assure that items are properly handled and packaged.

- Assure that appropriate housekeeping, contamination, and cleanliness requirements are maintained.

- Assure that requirements of D08935 are being met for special handling of electrostatic sensitive devices, circuits and assemblies.

6.2 ARTICLE AND MATERIAL CONTROLS (504.2)

Stores inspection personnel assure that only acceptable parts and materials are admitted into storage. Only approved units of hardware for subassemblies are supplied to the manufacturing line

for fabrication or assembly into the next higher assembly levels. Time-temperature sensitive materials are controlled by date codes and to required environmental levels, respectively, to prevent degradation prior to use.

Alerts that impact TRW projects typically result in the issuance of an internal Reliability Action Requirement (RAR). These RARs assign specific actions to individuals and/or functions to purge suspect parts/materials in hardware, kits, and stores. On completion of these actions, an RAR Closeout is issued, thus providing a closed loop system.

6.2.1 Procurement Quality

- Reviews purchase orders prior to issue to assure that proper handling, packaging, storage and shipping requirements are imposed.

- Inspects incoming material to verify conformance of packaging to the purchase order requirements.

- Assures, prior to placement, that purchase orders for limited shelf life materials include the appropriate quality requirements.

- Prepares and attaches appropriate shelf life labels to all materials listed in D01443.

6.2.2 Material Custodian (organization in possession of material)

- Provides suitable environment for materials under his/her control. Identifies materials which are over age or otherwise questionable and disposes of them in accordance with established procedures.

6.2.3 Quality Assurance (cognizant inspection organization)

- Assure that expired material is not used for production of AXAF deliverable hardware.

6.2.4 Material Shelf Life

The Shelf Life Control Document, D01443, is the single reference for all shelf life and storage condition information. D01443 is prepared and updated jointly by the Manufacturing Division Materials and Processes Engineering and Materials Engineering organizations. Coordination for changes will include Quality Assurance, Manufacturing and Material.

6.2.5 Identification and Control

Incoming limited shelf life items are inspected and tested in accordance with the applicable material specification, source

control drawing or vendor data sheets. Shelf life and environmental storage conditions are specified in D01443.

The shelf life labels specify the expiration date of the material, the batch or lot number for the material, the purchase order number and the storage condition.

Shelf life labels are normally attached directly to the container or material. If materials are repackaged at a later date, duplicate labels are obtained as required from inspection.

If storage conditions for a material are to be changed, inspection prepares a revised shelf life label. The remaining shelf life the material is determined by the cognizant materials engineer unless specifically established by D01143.

6.2.6 Suspension

When the shelf life expiration date is reached, the material custodian withholds it from use by placing a "Suspended" label (Systems Form 5326) over the expiration date portion of the shelf life label. Suspended material may be retained in the area pending disposition, but may not be used until dispositioned as described below. Suspended material is separated and stored in a locked container to prevent comingling.

Materials which have not reached their expiration date but are suspect due to leakage, change in color, change in consistency, etc., are also withheld from use by contacting the material custodian who places a "Suspended" label over the expiration date portion of the shelf life label.

Suspended material is dispositioned by the cognizant manufacturing and/or material organizations in one of three ways:

a. Routed to the cognizant materials engineering department for recertification per Paragraph 6.2.7.

b. Routed to surplus for disposal on a property movement authorization (PMA). NOTE: Contract inventory materials must be returned to Stores on a parts replacement requisition (PRR).

c. Tagged "Not for Production Use".

Expired materials may be retained by attaching Systems Form 5327, "Not for Production Use", over the shelf life label accept stamp. This category of material is suitable only for nonproduction related activities such as laboratory work, bread boarding and assembly aid fabrication.

6.2.7 Recertification

Unless specifically prohibited by the controlling material specification or by project management directive, material may

continue to be recertified at the end of each shelf life expiration date until it no longer conforms to the requirements of the applicable material specification, source control drawing or vendor data sheet.

6.3 CLEANLINESS/CONTAMINATION CONTROL (504.3)

Contamination and cleanliness control for the AXAF Program is described in and governed by the AXAF Contamination Control Plan. Manufacturing and test areas are monitored by Quality Assurance to confirm that the specific levels required by the plan remain within acceptable ranges. All manufacturing and test areas are posted, at the entrance, with the required level of cleanliness and access control. Spacecraft Assembly and Test areas are included in the Contamination Control Plan and their cleanliness and access control are also posted at the area entrance.

6.4 PROCESS CONTROLS (504.4)

6.4.1 General

Process controls including but not limited to metallurgical and chemical processes, metal joining processes (welding, brazing, soldering, crimping, wirewrap), bonding processes, etc. for AXAF will be implemented as defined below:

The flowdown of technical and quality assurance requirements is provided through the issuance to procurement sources of SOWs, Equipment Specifications and Product Assurance Requirements documents. Drawings, specification, and Quality Project Requirements (QPRs) are used to flow the same information to the in-house manufacturing, assembly, test, and spacecraft assembly and test areas. The QPRs are prepared by the Project Quality manager to specify project unique quality assurance requirements to the using areas.

6.4.1.1 Personnel Certification for Special/Critical Processes

TRW maintains Special Process training of personnel and process certification/recertification procedures which are used in determining personnel proficiency with the process. Only personnel with current certifications perform Special Processes which have personnel certification requirements. Personnel inspecting the performance or output of such processes must also be currently certified when an understanding of the process and/or process-related skill is required to perform the inspection properly.

In cases where general specifications (such as Military (MIL) Specifications and TRW Process Specifications (PR)) are implemented by more detailed documentation (such as Fabrication/Inspection Process Procedures (FIPP) and Quality Planning Inspection Instructions (QPII) certification to the more detailed documentation may be substituted for certification to

the general specifications, for the specific processes which the detailed procedures cover.

Retraining is accomplished, or personnel certification is revoked, when an individual's proficiency is demonstrated to have deteriorated to an unacceptable level.

6.4.1.2 Special Process Capability Certification

Special Processes used on deliverable items are performed using equipment, or facilities which have current and applicable certifications. Resulting documentation, feedback and records are maintained on these processes. Records of Certification are maintained and include as a minimum; recertification intervals, expiration dates, and process documentation relative to the Certification.

Processes requiring capability certification when used on AXAF deliverable hardware products are identified in a CADM-released document, D03464, "Standard Special Processes List" (SSPL).

Project variations from SSPL requirements for capability certification are identified by the Project Quality manager (PQM) in a Quality Project Requirement (QPR).

6.4.2 Non-Destructive Evaluation (NDE)

The non-destructive evaluation techniques to be used during the AXAF procurement, manufacturing, assembly, and test activities will be similar to those currently used on other TRW spacecraft programs. They include but are not limited to X-ray, Dye Penetrant, Magnetic Particle, Ultrasonics, etc. As the design of the spacecraft and its components evolves, design, quality assurance, and PM&P engineers will determine which method is appropriate for the application and specify it on the drawing using the appropriate process specification to be used. These drawings are then reviewed prior to CDR and release into the company CADM system. NDE requirements are translated from the drawings to the appropriate manufacturing/inspection documentation by manufacturing and quality planners to assure that the correct method is used, recorded, and accepted.

6.4.3 Process Control Procedures

Process control requirements are coordinated with and documented by engineering in Process Requirement (PR) specifications. The Control including cleanliness control, are implemented by Fabrication Inspection Process Procedures (FIPPs) and these FIPPs and PRs are cited on the drawing. These documents are formally released and controlled by the TRW Configuration and Data Management (CADM) system.

6.4.4 Equipment Certification

Quality Assurance assures that equipment used for special processes conforms to appropriate certification procedures and calibration. Inspection of date tags, review of written certification procedures, etc. verifies process integrity.

6.5 WORKMANSHIP STANDARDS (504.5)

FIPPs are prepared to support engineering drawings and specification requirements when amplification or clarity is required. Workmanship criteria are provided in the FIPPs and on the face of engineering drawings. Detailed quality inspection instructions are written for inspection operations to provide the inspector with a clear indicator of what type of inspection to perform and prescribe workmanship acceptance criteria. These instructions are identified on the MSO for each inspection operation.

When attributes involved are not amenable to verbal or printed pictorial description, acceptance criteria may require physical samples of visual aids, for definition. The physical samples are identified and approved by the cognizant quality engineer. The sample remains in the custody of the quality inspection function.

6.6 CONTROL OF TEMPORARY INSTALLATIONS (504.6)

Items that are temporarily installed on the AXAF are documented, identified, and controlled to assure that they are removed at the appropriate time. A special red/green tag procedure is used to provide control of temporary installed items for removal (red tag) and also items requiring installation prior to launch (green tag). The red/green tag procedure provides a listing of these items that are checked and verified by QA when installed and removed. Quality Assurance will monitor and record all handling of red and green tag items, as well as assuming responsibility for tracking these items and for maintaining a secured area for storage of red tag items.

7.0 TESTING, INSPECTIONS, AND EVALUATIONS (505)

Ref. HQAM 4.2, 4.4, 4.7, 4.8, 4.10, 7.1, 9.2, 9.5, 13.2, 14.1

7.1 TESTING, INSPECTIONS, AND EVALUATIONS (505.1)

The AXAF Program will use preplanned/prepared documents (MSO, PAL, FIPP) to assure that the inspections and tests performed meet the drawing, specification, test plans, and procedures and ultimately the contract requirements. These documents require objective evidence that the quality is maintained during the manufacturing, assembly and test cycles throughout the contract.

Specific flow charts, for all phases of the AXAF Program which integrates the manufacturing and test activity with TRW inspections will be prepared and provided to the NASA/DPRO representatives prior to CDR. These will be used by the government representatives to integrate the NASA-DPRO MGIs into the manufacturing, assembly, test, and inspection sequence.

These preplanning documents and the flowcharts are reviewed against the implementing documents and the requirements documents to assure requirements compliance.

7.1.1 Quality Assurance Inspection Personnel

- o Verifies that tests performed on AXAF are conducted to the latest revision of approved test procedures released by the engineering data release authority.

- o Assures that:

a. Only custodial test equipment (CTE) which is calibrated is used to determine compliance to specifications.

b. Measuring and test equipment/measurement systems/measurement standards (M&TE/MSys/MStd) labeled "Inactive" or "Invalid for Use" or equipment with apparent damage or broken calibration seals, are not used.

c. When notified of an equipment out-of-tolerance condition by an equipment performance report (EPR), an evaluation is performed to determine the impact on product tested.

d. Assures CTE is controlled.

e. Assures CTE listing is completed and attached to test procedure.

- o Notifies appropriate DPRO representative of hardware readiness for MGIs in the test sequence.

- Assures that test discrepancies are identified and recorded per QD instructions as they occur during the test sequence. Confirmed test discrepancies attributed to faults in the hardware under test are recorded on individual test discrepancy reports (TDRs). Test discrepancy hardware documentation flow is defined in detail in the AXAF Reliability Plan (PA05). Confirmed failures are transferred to NMRs for disposition and rework.

- Reviews test data following completion of tests to determine whether the hardware has passed or failed the test criteria. Test records for hardware which meets test criteria are stamped, and the hardware is forwarded to the next operation.

- Assures timely entry of test discrepancy data into a test discrepancy data system in accordance with applicable QDs.

7.2 INSPECTION AND TEST PLANNING (505.2)

Fabrication, assembly, test, and inspections are planned and documented prior to the commencement of the manufacturing cycle. The document used during the manufacturing cycle at TRW is the Manufacturing Shop Order (MSO) and the form used during subsystem and system integration is the Routing and Operations Card. Both of these documents are maintained for the contract span to provide evidence and traceability to the work performed and the performers.

These documents provide objective evidence of the orderly and timely inspection and testing, the coordination and sequencing of inspection and testing which ensures satisfactory hardware, and evidence of a coordinated identification and acceptance at Mandatory Government Inspections (MGIs).

As the product design matures, Quality Engineering continually reviews the requirements for special processes, special tools and fixtures, templates, patterns and other manufacturing/inspection aids. The development and use of these devices are factored into the manufacturing and inspection planning to assure that proper accuracy of measurement is made.

7.3 TEST SPECIFICATIONS (505.3)

Specifications for each functional assembly and contract end-items are prepared by engineering and reflect design requirements, verification requirements, and program constraints. The specifications are reviewed and approved by quality engineering prior to release. Derived from these specifications are the qualification and acceptance test procedures that are used to verify compliance to contract requirements. These procedures are also reviewed by quality engineering prior to release.

7.4 INSPECTION AND TEST PROCEDURES (505.4)

Prior to the commencement of a test sequence the quality inspector assures that a "TEST COPY" of the latest CADM release is available at the test area. These test procedures have been reviewed by quality engineers to assure that the procedure conforms to the test specification for technical content, the TRW Specification Manual requirements for form and format. Quality will assure that each inspection and test procedure shall include:

a. Configuration and identification of the test item.

b. Inspection and test characteristics with tolerances.

c. Provisions for verification when designated by the Government quality representative.

d. Step-by-step operations designating sequence of performance.

e. Listing of inspection/test equipment.

f. Detailed instructions for operation of peripheral equipment.

g. Schematics, layouts, connections as required.

h. Identify safety hazards and precautions required for equipment and personnel.

i. Type of environments to be maintained.

j. Workmanship standards as applicable.

k. Constraints on inspection or testing.

l. Method of inspection test anomaly reporting.

m. Sampling methods to be used.

n. Nondestructive methods as required by specification.

The specific article under test is recorded by part number, revision letter, and serial number in the procedure and the test procedure is identified by revision letter in the manufacturing documentation. Both documents designate the identity of the inspection and test performers.

The Test Discrepancy Report (TDR) is generated for TRW in-house failures to travel with the hardware from the time of the failure. The nonconformance identification and initial findings are recorded on this form. One copy of this report stays with the hardware as it proceeds through troubleshooting, rework, and retest. Additional copies are distributed to AXAF reliability, the component engineer, and the computer data files.

The Nonconformance and Resolution Report is generated for both in-house and subcontractor failures and is submitted to MSFC within 5 days of the nonconformance. Final results (or a status) of the failure analysis and corrective action are subsequently entered onto this report and are forwarded to MSFC within 21 days of the nonconformance.

7.5 INSPECTION AND TEST PERFORMANCE (505.5)

7.5.1 Inspection and Tests

Quality Assurance Inspectors participate throughout the entire procurement, fabrication, assembly, and test cycle on deliverable products. The manufacturing and assembly activities up to the point of spacecraft assembly are documented on Manufacturing Shop Orders. These travelers identify the documentation that is required, i.e., drawings, procedures, and specifications that are required to perform the manufacturing and inspection activities. They also provide traceability to the personnel who performed/inspected each assembly and test step. Reinspection and retest criteria will be applied as defined in planning documents, test discerpancy report instructions, MRB instructions, or engineer retest requests.

7.5.2 Qualification Test Articles

A Quality Project Requirements (QPR) document will be written prior to the commencement of the manufacturing/test cycle that will describe the requirements for the Qualification Test Article and will include, as appropriate to the specific content of each QPR, the following items:

a. Manufacturing and inspection records
b. End-item inspection and test specifications and procedures
c. Authorized deviations
d. Nonconformances
e. Approved waivers
f. Removal and installation records
g. Operating time records
h. Change verification records
i. Safety procedures
j. Emergency shutdown procedures
k. Rework and retest criteria
l. Procedures for use of special measuring devices
m. Software revision used for automatic testing

These records and procedures are maintained in the manufacturing traveler package that accompanies each item being assembled, tested and inspected.

Incrementally, when completed, these records are retired to a retention area where they are maintained readily available for use.

7.5.3 End-Item Inspection and Test and Pre-Installation Tests

The AXAF test and assembly activity is controlled through the use of Routing and Operation cards. The test data package that is accumulated at the end of each sequence identifies the Test Conductor and Quality Assurance representative involved.

Deliverable hardware may not be subjected to any operations without directions on the MSO or dispositioned discrepancy paperwork.

A series of functional tests and inspections are performed during the manufacturing, assembly, and test cycles to assure that the product is meeting its lower level requirements and no damage will occur from untested/inspected products at a higher level of assembly.

7.5.4 End-Item Reinspection and Retest

Retest and or reinspection are required when work is performed that disrupts an area or test already completed. Adjustments, equipment malfunctions, modifications, repairs, replacements, or rework after completion of end-item inspections and tests will require prior approval of the designated MSFC/DPRO Government quality representative.

The extent of retest and reinspection is determined by the responsible Design Engineer, Quality Assurance, and Reliability.

7.6 INSPECTION AND TEST RECORDS AND DATA (505.6)

TRW generates and maintains records of every activity that occurs to a deliverable product. These records start with the procurement documentation reviewed at receiving inspection. They are carried to the MSO which describes the fabrication, assembly, inspection, and test of each product at the unit level. At the unit level, for assemblies, test data packages are accumulated which describe the entire manufacturing cycle and stored for easy retrieval. At the Integration stores, the product is transferred to an R&O card and then is tracked through the accumulated test data packages provided to describe the test history of the final product. Product run time, power on time and cycle logs are maintained as required. These records are reviewed and approved by Quality Assurance prior to the products move to the next operation.

Quality Assurance assures through review, that the end-item data packages for each deliverable item is complete and meets the requirements of MSFC.

7.7 CONTRACTOR QUALITY ASSURANCE ACTIONS (505.7)

Quality Assurance performs pretest inspections in accordance with the Quality Directives (QD) provided for that activity. These QDs reflect the requirements of the HQAM. They address

documentation, test equipment calibration, Government notification, test set-up and configuration, and verify that the test article is ready for test.

During the test sequence, the quality assurance representative verifies the data recorded is accurate and meets the requirements of the pass-fail criteria stipulated in the procedure. He also documents any nonconformances and their disposition as well as any repair, rework, or modifications performed.

Subsequent to the test activity, the quality assurance representative assures that all nonconformances are identified and dispositioned. He also verifies that the test results are accurate, complete and traceable to the tested article. He further assures that the final Data Package is correct and includes the complete documentation developed during the test.

7.8 WALK-THROUGH SHAKEDOWN INSPECTION (505.8)

TRW quality assurance shall prepare for and conduct periodic walk-through/shakedown inspections. These inspections are held to assure that the AXAF is properly prepared and ready for its upcoming activity and their timing is determined by hardware defect rates, routine inspection results, quality trends, maturity of the assembly and test process and major move points in that process.

In some cases where movement of the AXAF is involved, a dry run practice move using a spacecraft model is made to assure that there are no obstructions to impede the safe movement from one area to another.

The AXAF Project Quality Manager will prepare a QPR to the AXAF A&T QA activity directing them to contact the NASA/DPRO QA representatives and notify them in sufficient time to participate in the Walk-through/Shakedown process. The QPR will further direct that a physical inspection of the AXAF be made by QA, and Test Conductor, and MSFC/DPRO representatives immediately prior to major test/movement commencement. Any movement of AXAF requires Safety Engineering approval.

The results of each Walk/through/Shakedown inspection will be reported at the completion of that activity.

7.9 QUALITY ASSURANCE DESIGNEES (505.9)

TRW does not currently use DESIGNEES to represent the QA organization in performance of selected inspection acceptance functions. Future use of quality assurance designees is anticipated when appropriate and can be cost effective. That use will be subject to an approved plan which implements the activity.

7.10 AXAF ACCESS CONTROL (505.10)

Once the end-item AXAF commences its build up assembly and test activity, access to the AXAF area is restricted to those who have reason to be in the area.

At an appropriate point in the AXAF assembly, control will be instituted to assure that foreign items are not left in the AXAF while it is in the close up activity. The AXAF Contamination Control Plan provides the standards to which the AXAF is environmentally protected.

Access to the manufacturing area(s) and storerooms of components and their subassemblies is restricted to only the manufacturing support personnel normally required in those areas.

7.11 GSE ACCESS CONTROL (505.11)

Any AXAF GSE which directly monitors and or controls the AXAF vehicle during check out and launch and which, due to design, normally requires opening to perform modifications, inspections, or repair will be included in an access control system after validation and inspection acceptance.

7.12 INTEGRITY CONTROL (505.12)

The integrity of the deliverable product is established and monitored during its entire life cycle. Division Standard practices, QA Directives, and Quality Project Requirements documents control the activities and are written to assure that the end product is protected from harm.

8.0 NONCONFORMING ARTICLES AND MATERIALS (506)

Ref. HQAM 3.8, 3.12, 9.1, 9.5, 15

8.1 NONCONFORMING ARTICLE AND MATERIAL CONTROL (506.1)

Nonconforming articles and materials detected and reported during the receiving, fabrication, assembly, and test inspection operations prior to time of Government acceptance are identified, segregated, and withheld in controlled areas where feasible. To provide positive segregation of nonconforming material, controlled areas are established in the areas of receiving inspection, manufacturing assembly and test. When segregation is not feasible, or physically impossible, the item is bonded in place with a Withhold Tag and held there for material review.

8.2 NONCONFORMANCE REPORTING AND CORRECTION (506.2)

The TRW HQAM establishes a controlled, closed loop documentation system for reporting nonconformances discovered during processing of program hardware. After the recording of the nonconformance; the appropriate reporting, analyzing, correcting, and feedback necessary to assure complete corrective action has been taken which will preclude future-like occurrences. It commences at the time of initiation of the procurement cycle and proceeds through the subsequent phases of the program up to and including the launch activity. It is extended to the support hardware such as EGSE and MGSE.

Nonconformances are reported on a preprinted, serialized form that provides space for the accumulation of the data necessary to provide the identification of the nonconformance in specific detail, the item(s) affected, date of discovery, cause, disposition, corrective action taken, initiator of the form, and signatures of the authorized personnel who concurred with the information contained on the document. Also included is the type of activity in process at the time of the nonconformance, area responsible, classification, and notation as to the repair procedures used.

TRW has established and maintains an appropriate number of corrective action boards (CABs) and corrective action control centers (CACCs) operating at the division level to assure that root causes of nonconformances are identified and that effective preventive action measures are implemented.

Summary data on nonconformances, failure recurrences, trends, corrective actions, dispositions, and cost data when appropriate are used by the Division Level CAB to determine the need for and effectivity of corrective action.

Preliminary review of nonconformances is performed by an evaluation team comprised of approved quality assurance and manufacturing representatives who have the authority to make joint dispositions in accordance with defective material

reporting, control and evaluation procedures. These procedures are limited to Return to Supplier, Rework to Drawing/Specification requirements, Reinspect, Scrap, Repair per Standard Repair Procedure (when the SRP has initial MRB and MSFC approval), or Submit to MRB. Consideration will be given to alternate uses of the "scrapped" material as training aid engineering lab use or other means of minimizing the financial loss resulting from scrap dispositions.

Monthly nonconformance summary reports (DR PA12) will be submitted to MSFC for the AXAF project.

Nonconformance dispositions that affect contract End Item Specifications must have MSFC contracting officer approval.

8.3 MATERIAL REVIEW BOARD (506.3)

Nonconforming deliverable material referred to Material Review Board (MRB) is dispositioned by designated TRW design and quality engineers, appointed to and acting together as an MRB. DPRO is delegated MRB authority and its quality representative is the third member of the board.

MRB members are selected on the basis of their technical competence and skills to evaluate material nonconformances and provide proper or recommended dispositions.

The MRB members are responsible for the timely investigation of all nonconforming material referred to it in sufficient depth to determine a proper or recommended disposition.

The MRB, by unanimous decision, determines the recommended disposition to Rework, Repair, Standard Repair Procedure-SRP, (when approved by MSFC), Use-As-Is, or request for Waiver. Where unanimous decisions cannot be reached, the problem is elevated to higher management for resolution.

TRW provides controlled and secure material review areas at convenient locations for segregation of nonconforming material where feasible.

Subcontractors having "design cognizance" may request MRB authority for variations which have no effect on end item form, fit or function, or which are not in conflict with the contract requirements. This authority will be delegated following TRW and MSFC approval of the subcontractor's MRB procedures and board members. All delegated material review actions are subject to review by the AXAF program and MSFC representatives at the subcontractor's facility, or upon receipt at TRW.

Suppliers may elect to scrap nonconforming material or return the material to specification condition through his internal material review procedures. Unless TRW, with MSFC approval, has delegated MRB authority to the supplier, all requests for "Repair", or "Use-As-Is" consideration must be submitted on a Supplier

Information Request (SIR) form through the cognizant TRW buyer or subcontract administrator for a TRW/AXAF MRB disposition.

MRB activities are detailed in the following sections.

8.3.1 Material Review Board Areas

Nonconforming material is conspicuously identified with a withhold tag and positively controlled to preclude unauthorized use in deliverable products.

When appropriate, QA provides controlled and secure material review areas at convenient locations for segregation of nonconforming material. Locked cabinets shall be used for storage of nonconforming material in unsecured areas. Access to material is controlled by QA.

A nonconforming item which cannot practically be removed to an MRB area is normally identified with a Withhold Tag by the inspector initiating the Discrepancy Report (DR). For items integrated into the all-up AXAF, the nonconforming item is documented in a "Squawk Report" entry. The Withhold Tag or "Squawk Report" entry is cleared by authorized QA personnel upon receipt of disposition by MRB or other appropriate authorization.

8.3.2 Material Review Composition

MRBs include a minimum of three members:

a. A TRW QA member who is the board Chairman.

b. A TRW engineering member representing the responsible design activity.

c. A DPRO QA Representative representing the customer.

MRBs will request and be supported by additional participation from other disciplines when this will facilitate determination of dispositions.

8.3.3 Member Selection

MRB members are selected on the basis of their technical competence and skills to evaluate material nonconformances and provide proper or recommended dispositions. For the material under consideration, they must be knowledgeable of the appropriate criteria of the defined level of product description documentation.

The Project Quality Manager (PQM) appoints the QA member and alternates, and assures that appropriate engineering members and alternates are assigned from the cognizant engineering activities. The PQM issues the AXAF Program MRB List, including appropriate changes thereto.

The PQM obtains the names of DPRO/MSFC representatives appointed as board members and appends them to the list of TRW board members.

The AXAF Program "Material Review Board List" will be controlled and distributed through CADM.

8.3.4 Training of MRB Members

Training of MRB members will be conducted to assure members are familiar with the policies and procedures of the applicable QAM, Quality Directives (QDs) and Quality Project Requirements (QPRs).

8.3.5 Material Review Board Actions

Evaluation

The MRB investigates, in a timely manner, all nonconforming material referred to it in sufficient depth to determine a proper or recommended disposition.

To assist in the disposition of nonconforming material submitted to the MRB, reinspection, or retest, may be required. The MRB direction will provide adequate work and inspection instructions to define the scope of the evaluation work and the proper or recommended disposition of the individual units of nonconforming material.

Disposition

The board, by unanimous decision, determines the proper or recommended disposition from one of the following options. Where unanimous decision cannot be reached, the problem is elevated to higher management for resolution:

MAY BE AUTHORIZED WITHOUT PRIOR DPRO/MSFC REPRESENTATIVE APPROVAL

Scrap

The nonconforming material is not usable for its intended purpose and cannot be economically reworked or repaired.

Rework

The nonconforming material can be reprocessed to make it conform completely to the drawings, specifications, or contract requirements.

Return to Supplier/Subcontractor/Subsidiary

The nonconforming material is a supplier/subcontractor/subsidiary responsibility and the material is returned for rework, replacement, or credit.

Use a Standard Repair

The nonconforming material can be reduced to a nonconformance that does not adversely impact form, fit, or function using a

Standard Repair Process/Procedure (SRP) authorized for use on AXAF and initially approved by the Material Review Board and MSFC.

OR RECOMMEND TO DPRO/MSFC REPRESENTATIVE FOR AUTHORIZATION

Recommend a repair by other than a Standard Repair Process which will reduce the nonconformance to one that does not adversely impact form, fit, or function. The repair procedure must be approved.

Recommend "use as is" where the nonconformance is evaluated to be a nonconformance that does not adversely impact form, fit or function and the items suitable for its intended use.

OR REQUEST A WAIVER FROM THE MSFC CONTRACTING OFFICER

For authorization to proceed with a repair or "use as is" disposition on a nonconformance which adversely affects any of the following:

a. Health or Safety
b. Performance
c. Interchangeability, reliability, or maintainability
d. Effective use or operation
e. Weight or appearance (when a factor)
f. Cost change
g. Contract Requirements

8.3.6 Local DPRO/MSFC Approval of Dispositions

The MRB recommends to the DPRO/MSFC quality representative "repair" and "use as is" dispositions and obtains prior approval before further processing.

Emergency Proceedings at Project Risk

a. Should DPRO/MSFC representative approval of an MRB-recommended disposition be required and the DPRO/MSFC representative approval cannot be obtained, the processing for "repair" or "use as is" may proceed at project risk provided that:

   1. MRB concurs.

   2. MRB action is outside of DPRO/MSFC representative normal working hours.

      o There is no DPRO/MSFC representative 2nd or 3rd shift.

- o There is no DPRO/MSFC representative available to participate.

- o And, this action is annotated in the DR/PDR documentation.

3. The MRB action must be presented to a DPRO/MSFC representative on the next scheduled workday or shift for review and approval with a statement as to the precise location of the nonconforming material.

4. The nonconforming material affected can be located promptly by its identification for a DPRO/MSFC representative post review, if desired.

b. If the implementing planning for the recommended disposition also requires additional approval by DPRO/MSFC of the Quality Planning, the procedure above shall also apply for each approval of the implementing planning.

c. Further processing at project risk pending DPRO/MSFC approval is authorized by use of a Withhold Tag or Squawk Report entry.

Procured items, where a nonconformance is assessed as a supplier/subcontractor/subsidiary responsibility and where the items have previously been government source inspected, are presented to the government quality assurance representative for review and guidance prior to further processing.

8.3.7 Processing Dispositioned Material

Scrap

Material is destroyed, rendered unfit for use or physically marked as "scrap". Such identification is accomplished by ink stamping, steel impression stamping, electric pencil etching or conspicuous marking with red paint or dye. After being rendered unfit for use or conspicuously identified as "scrap", nonconforming material may be released by the MRB for use for machine setup, training, or further evaluation.

An item not diverted to alternate use is recorded on a Property Movement Authorization (PMA) and routed to the Property Surplus Area. The quantity scrapped and scrap costs are recorded on the DR/PDR in accordance with applicable quality directives.

Rework and Repair

Items are routed to the appropriate work group with a DR/PDR document, with appropriately-detailed rework or repair instructions: Complex instructions are provided on the work documents normally used in the area which is to perform the work.

Acceptance after rework or repair operations is identified by acceptance stamping the documentation, with an acceptance stamp impression interlocking with the rejection stamp, as applicable, on the DR/PDR document.

At the request of the DPRO/MSFC quality representative, items dispositioned for repair shall receive a Mandatory Government Inspection.

Additional nonconformances identified during the process of rework/repair or reinspection are recorded on a new DR/PDR document.

Return to Supplier/Subcontractor/Subsidiary

Items rejected during in-process inspection and assessed as supplier/subcontactor/subsidiary responsibility are routed via NMR to the Procurement Quality MRB for processing. The PQ MRB transfers the necessary information from the NMR to a PDR.

Use-As-Is

Items are returned to the normal production flow on the original manufacturing or receiving documentation. Acceptance of the nonconformance is indicated on the DR/PDR and by interlocking the original rejection stamp with an acceptable stamp as applicable. A copy of the DR/PDR is retained with the data package.

Waiver

When authorization is granted by MSFC or MRB, the item is returned to the normal production flow on the original manufacturing or receiving documentation. A copy of the approved waiver/NMR is added to the data package and a notation of the waiver granted is included in the delivery documentation pertaining to the item. Approval of the waiver is indicated on the DR/PDR and by interlocking the original rejection stamp with an acceptance stamp as applicable on the manufacturing or receiving documentation. A copy of DR/PDR is maintained with the data package.

8.3.8 Corrective Action

Each nonconformance dispositioned by MRB is evaluated for cause, responsibility, corrective action, and effectiveness of prior corrective actions. Information is included on the DR/PDR identifying the cognizant organization and representative taking the corrective action to allow closed loop tracking and follow-up by the CACC/CAB.

8.3.9 Records

PR and MR records of nonconformance material, assignable causes, dispositions, corrective actions, and effectiveness of corrective actions are maintained by Group Product Assurance personnel in

accordance with local quality directives. These records are organized to permit efficient retrieval.

The Monthly Summary Report of AXAF Nonconformances will be provided to the MSFC S&MA representative.

8.4 CONTRACTING OFFICER (506.4)

Waivers may be submitted to the Contracting Officer after review with the DPRO for comments. They will be accompanied by written recommendation and proposed remedial and preventive action. Articles and materials shall be withheld from further processing until appropriate approval is obtained.

Deviations will be requested directly from the contracting officer. They will be accompanied by written recommendations and where appropriate proposed remedial and preventive action.

9.0 METROLOGY (507)

Ref. HQAM 2.1, 2.2, 2.3, 2.4, 15.2, 15.3, 15.4, 15.5

9.1 METROLOGY CONTROLS (507.1)

TRW employs a system for the selection, evaluation, maintenance, and control of reference and transfer standards, as well as measuring and test equipment. Each instrument or other measuring apparatus on which the accuracy and precision of test results depends, is calibrated in accordance with established TRW calibration procedures, or more frequently where conditions warrant.

Specification MIL-STD-45662 is incorporated into each purchase order and subcontract for products requiring measurement and test to determine conformance with requirements. The suppliers calibration system and equipment is evaluated and audited by Quality Assurance.

9.2 ACCEPTANCE (507.2)

TRW's quality assurance verifies, as part of pre-test or measurement procedure, that the measuring and test equipment (M&TE) to be used has a calibration tag indicating that the equipment is within the calibration cycle and that the cycle will not expire prior to the completion of that use. M&TE, with calibration that is outside of the required test period, is rejected for use.

9.3 EVALUATION (507.3)

TRW QA verifies that measurement equipment meets the requirements for accuracy, that standards and equipment are commensurate with hardware and environmental conditions and that operating instructions are available. Specific QA functions include:

a. Notifies projects when calibration capability cannot meet project measurement requirements.

b. Assures that delegated calibration sources perform to calibration requirements.

c. Assures that suppliers used by the Equipment Management Center (EMC) for calibration are adequate to meet contractual requirements.

d. Assures that objective evidence of the measurement capability to meet requirements is current and readily available.

e. Identifies those capabilities which may not meet contract requirements and assures positive corrective action.

f. Assures that M&TE is performing within specification and identifies M&TE suspected to be out-of-tolerance or not performing as required and issues withhold tag.

g. Reviews out-of-tolerance conditions with cognizant organization to determine possibility of negative impact on test capability and product quality conformance.

Assures that:

a. Audits are performed on M&TE, in use, to assure that the M&TE is within the allowed use period and is controlled and maintained within the environmental conditions established by the applicable test procedure requirements.

b. Suppliers/subcontractors/subsidiaries have the capability, supplies and services to comply with contract requirements.

c. MTE is used within defined conditions and interval of use, and is released for recall purposes.

d. Released test specifications/procedures direct the use of demonstrated custodial test equipment (CTE), i.e., MTE to establish product conformance to technical requirements.

e. "Out-of tolerance" conditions identified on an EPR are evaluated for affects on product quality. Advises EMC of final closure of each EPR.

f. Suppliers/subcontractors/subsidiaries' calibration sources are approved for adequacy, capability and traceability to provide the required supplies and services.

g. The calibration system is applied and is supported by records for each M&TE used to qualify/accept deliverable products.

h. The indicated calibration status of M&TE shows use-conditions and expiration date of use. If MCE labels cannot be read or other anomaly exists, places withhold tag on M&TE, suspends use and requests immediate EMC review.

i. Requirements for calibration system are passed down to suppliers/subcontractors/subsidiaries and that suppliers/subcontractors/subsidiaries maintain the capability to meet such requirements.

j. M&TE is handled, stored and transported in a manner which does not adversely affect its calibration and application integrity.

Assures that EMC is notified when a contractual measurement requirements is beyond the existing capability of approved sources.

Verifies and accepts/rejects delegated calibration performed to EMC calibration procedures.

Assures M&TE are not used beyond their calibration interval and are released for calibration at end of interval of use or when questionable performance is observed.

Based on schedule requirements, reviews M&TE application for impact on products which might be tested just prior to or subsequent to expiration of the calibration period. If schedule and M&TE recall dates are in conflict, initiates a withhold tag and approves a request for extension-of-use period for the applicable M&TE, assuring delay of calibration does not affect product quality.

Notifies EMC of record and label due-date discrepancies.

Complies to calibration/recall system to meet EMC requirements.

Assures environmental conditions are in accordance with the test inspection procedure to provide continued accuracy of demonstrated CTE.

Assures and audits suppliers/subcontractors/subsidiaries' compliance with contractual calibration system requirements.

9.4 ARTICLE OR MATERIAL MEASUREMENT PROCESSES (507.4)

The measuring and test equipment (MT&E) to be used is selected to have an accuracy within 10% of the tolerance of the hardware characteristic to be measured, unless restricted by state-of-the-art limitations. Authority for exemption, from this requirement, must be requested from the AXAF project office and coordinated with the in-house MSFC Representative.

9.5 CALIBRATION MEASUREMENT PROCESS (507.5)

The accuracy of the metrology standards is within 25% of the tolerance of the characteristics on the test or measuring equipment being calibrated, unless restricted by state-of-the-art limitations. Authority for exception will be requested from the AXAF project office and coordinated with the in-house MSFC Representative.

9.6 CALIBRATION CONTROLS (507.6)

TRW's Equipment Control Department maintains measurement standards established by the Institute of Standards Technology. Secondary standards are certified to the primary standards and are used, as required, for calibration of equipment.

Identification and labeling of measuring and test equipment are in accordance with standard metrology practices and procedures. Calibration status and identification are accomplished by application of an appropriate instrument calibration label.

Calibration intervals are established by Metrology, based on equipment stability, application, and usage. When size, configuration, or functional characteristics of the equipment prohibit the application of calibration labels, a small identifying dot is applied to the item to reflect the next calibration due date. Master calibration color code charts, displayed and available throughout the manufacturing and test areas, show the required color code per calendar month. Calibration due dates fall on the last working day of the month where such color codes are used.

The maintenance and calibration intervals for each controlled item of measuring and test equipment is determined by the requirements,use, accuracy, type, and other factors affecting the measuring capability. Automatic schedules for periodic mandatory calibration and/or maintenance of measuring and test equipment are established by the Metrology Department.

The TRW metrology recall system is an automated system of preprinted test equipment calibration work orders which are sent to the test equipment custodial organization. If the custodial organization fails to respond to the recall system, and the equipment is not submitted for recalibration, test inspectors prohibit the use of such equipment in hardware acceptance testing.

Calibration records are maintained on the test equipment by control number list, which provides manufacturer/model/description, calibration interval, control status, dates of last and next due calibration, accountable department and location, and also applicable calibration procedure or specification. The metrology technician performing the calibration affixes his stamp impression on the tag placed on the equipment.

All measuring and test equipment is handled, stored, and transported, as delicate equipment, in a manner that will not adversely affect quality or result in hazardous conditions.

9.7 ENVIRONMENTAL REQUIREMENTS (507.7)

Environmental characteristics are taken into consideration when selecting the appropriate measuring and test equipment. These characteristics (e.g., temperature, humidity, vibration, cleanliness) are determined to be compatible with the accuracy requirements of the article and material and calibration measurement process.

9.8 REMEDIAL AND PREVENTIVE ACTION (507.8)

The TRW metrology system has been developed to take remedial and preventive action when measurement standards or equipment are found to be nonconforming. Remedial action is extended to the

article and material measured, when a M&TE nonconformance is found and that M&TE has been used in acceptance measurements and tests.

10.0 STAMP CONTROLS (508)

10.1 STAMP CONTROL (508.1)

Inspection stamps are used to identify that articles and material have undergone their prescribed inspections and indicate the acceptance/reject status. Quality status stamps are of unique configurations, with each configuration used for a specific application. Stamps may not be modified in any manner. A description and explanation of the stamp control process follows.

10.1.1 Stamp Control Clerk

Requisitions new or replacement stamps. On receipt of newly purchased stamps, verifies that configurations and serial numbers are as specified on the purchase requisition.

Initiates and maintains a quality assurance stamp record for each stamp. Stamp records are protected from unauthorized access.

Issues or transfers stamps on receipt of approved quality assurance stamp requests. Makes entries on stamp requests and retains copies of completed stamp requests in a secured file. In the case of an authorized transfer of stamps to another unit, transfers all applicable stamp records and stamp requests also.

Retains the unissued stamps in a secured file.

Assures the destruction of stamps which are unserviceable or obsolete and impounding stamps recovered after reported lost or missing.

Prepares and maintains records which show the current status of all quality status stamps assigned including lost or missing stamps.

10.1.2 Quality Assurance Supervisors

Approve issuance or transfer of stamps for supervised personnel by approving stamp requests.

Supervise care and use of stamps.

Assure return of stamps to the stamp control clerk when an employee is terminated or transferred or when a stamp is obsoleted for use. Notify the stamp control clerk of lost stamps.

10.1.3 Personnel Issued Stamps

Protect stamps from loss and from use by an other person. Report lost stamps immediately to supervision.

Maintain and use stamps in such a manner as to assure legible impressions. Return stamps incapable of making legible impressions to the stamp control clerk.

Select the stamp to use, (i.e., plastic, steel), based on material or item to be stamped. Exercise proper care to insure that the stamp impression will not damage or contaminate material to which stamps are applied.

Stamp impressions, when practical and unless otherwise specified, are applied directly to the inspected material or item, close to the assembly or part number. Stamp impressions are also made on accompanying or related records.

a. When the size, quantity of items, or other physical limitations make stamping on individual items impractical, stamp impressions are made on appropriate tags, cards, or container labels.

b. Whenever paperwork is stamped, the date when required is noted adjacent to stamp impressions, most unusually at locations identified for data entries on preprinted forms.

Surrender all stamps to the stamp control clerk upon termination or transfer, unless retention of the stamps is authorized by both of the supervisors involved in a transfer. Surrender obsolete stamps upon notification of a stamp configuration being made obsolete.

A record of assignment of each inspection stamp is maintained by Quality Assurance and is available to the cognizant MSFC/Government representative. Traceability of each inspection stamp to its user is maintained and verified. The use of any stamp by an individual other than the authorized holder is specifically prohibited.

Worn or damaged stamps that produce illegible or otherwise unsatisfactory stamp impressions are returned to Stamp Control for replacement. Returned or lost stamps are immediately reported to quality assurance for appropriate disposition.

10.2 STAMP RESTRICTION (508.2)

TRW fabrication and inspection stamps do not bear any resemblance to NASA or DOD designations.

11. HANDLING STORAGE, PRESERVATION, MARKING, LABELING, PACKAGING, PACKING, AND SHIPPING (509)

Ref. HQAM 12.1

11.1 HANDLING AND STORAGE (509.1,2)

Quality Assurance verifies that items are handled in accordance with established requirements and specified handling equipment. Items are inspected at predetermined points to ensure that they are adequately protected and that the characteristics of quality are not impaired or degraded by handling. The operations for handling of the AXAF at the launch site will be in accordance with the AXAF Launch Site Support Plan.

Storage storerooms for component parts awaiting assembly, subassemblies awaiting further assembly, or finished assemblies awaiting spacecraft system test and/or shipment, are controlled limited access areas. Items for AXAF use are segregated. Parts and assemblies are identified and binned by part number, serial number, and/or lot control number and show evidence of acceptance. Raw materials are coded and identified. Limited shelf-life items show shelf-life expiration date. Periodic audits of storeroom facilities are conducted by Quality Assurance personnel to verify adequate maintenance of items.

The completed AXAF and space flight support equipment will be stored in environmentally controlled storage areas, enclosed in protective containers, designed to prevent degradation or damage in the storage and handling environments.

11.2 PRESERVATION, MARKING, LABELING, PACKAGING, AND PACKING (509.3-7)

Hardware sensitive to environmental deterioration is identified and appropriate measures are taken to protect such equipment during storage, fabrication, and testing operations. These requirements, consistent with the AXAF Contamination Control Plan, will be documented on FIPP, MSO, or R&O instructions, as appropriate and verified by quality assurance to ensure compliance.

Quality Assurance monitors packaging for adequacy of protective containers and packing materials for prevention of damage in shipment or storage, compliance with marking requirements, inspection of package before and after shipping or storage in-plant, accessibility of deliverable item if inspection is required in the container, and operation of recording devices for measurement of special environments.

Prior to the inspection of the packaging operations, quality assurance will determine the adequacy of packing provided to prevent equipment damage within the container during handling and transit. Packing requirements will be in accordance with AXAF Transportation and Handling Plan.

Inspection of equipment container marking and labeling will be in accordance with AXAF Transportation and Handling Plan to provide the necessary information and protection for the equipment in the container.

11.3 SHIPPING (509.8)

Quality assurance personnel during shipping operations, ensure that deliverable end items reflect:

a. An end-item data package is assembled and checked for completeness and accuracy.

b. Deliverable end items are complete.

c. Articles have been preserved and packaged in accordance with the Contamination Control and Transportation and Handling Plans.

d. Articles have been tested and containers identified as required in accordance with proper procedures and specifications.

e. Required acceptance data are properly located and included as specified in the shipping procedure.

12.0 SAMPLING PLANS, STATISTICAL PLANNING, AND ANALYSIS (510)

Ref. HQAM 4.2

12.1 SAMPLING PLANS (510.1)

Sampling plans will be utilized on the AXAF Program when the acceptability of the hardware must be determined by destructive tests, or the noncritical application of the item indicates the quality level of the hardware can be assured by reduced testing or inspection.

TRW will use attributes sampling per MIL-STD-105, the use of any other plan must be approved by the AXAF Program and the MSFC S&MA Office.

12.2 STATISTICAL ANALYSIS (510.2)

Statistical planning and analysis is used, as appropriate, to determine defect trends and establish process control limits. It is also used where special processes and equipment are difficult to control. The information derived is used as a preventive action tool.

13.0 GOVERNMENT PROPERTY CONTROL (511)

Ref. HQAM 12.5

13.1 CONTRACTORS RESPONSIBILITY (511.1)

The TRW Property Manual and this plan govern control of Government Furnished Property (GFP) to be used on the AXAF Program. The requirements of this plan are flowed down to the appropriate subcontractors and suppliers of AXAF articles and materials. Enforcement of the policies documented in the TRW Property Manual and this plan ensure that GFP is properly identified, controlled, and handled to preclude loss, damage, or misuse.

The assigned Property Controller will be initially responsible for all Government property and associated documentation supplied by the Government. He will assure that the equipment is identified by TRW customer identification tags and associated serial numbers. The responsibility will transfer to the final custodian of the equipment when it is issued for use. The custodian shall maintain and update the logs supplied by the Government.

Receiving Inspection of GFP will primarily be an inspection to assure that the proper equipment, by part number and serial number, have been received and that there was no damage incurred during transportation to the TRW facility. More detailed inspection and testing are provided when required by contract and performed to specific checklists provided by the Government. A review of environmental and customer witnessing requirements will be made prior to unpacking each GFP item received. DPRO representative will be notified of all receiving inspection and test schedules for GFP.

The in-house DPRO representative will be notified if any GFP is found to be damaged upon receipt. A complete inspection will be performed to determine the extent of damage at the direction of the DPRO representative.

Receiving inspections and tests performed on GFP will be recorded on the appropriate standard TRW forms. These forms become part of the Program historical documentation for the article.

GFP will be retained in approved contract storage areas. Control of the area will be maintained as appropriate for the type of material or article stored. This storage and its controls will be commensurate with the equivalent articles produced for the AXAF Program by TRW and its suppliers.

GFP will be controlled in a manner that will preclude its use for unauthorized activities. The MSFC Contracting Officer shall be notified of any requests for the use of the GFP other than for AXAF Program work.

13.2 UNSUITABLE GOVERNMENT PROPERTY (511.2)

Malfunctioning, damaged, or otherwise defective equipment will be recorded on appropriate TRW nonconformance documents and reported to the designated Government representative for disposition. Discrepant, Government property will not be dispositioned, reworked, repaired, modified, or replaced without the specific written authorization of MSFC.

GFP nonconformances will be documented during the contract life cycle. These nonconformances will be reported to the proper MSFC authority. If the probable cause of the nonconformance is determined to be in TRW's operations or activities, corrective action will be instituted to preclude future occurrences.

14.0 FLIGHT TEST/GROUND OPERATIONS (512)

14.1 PROCEDURES (512.1)

TRW Quality Assurance will prepare Inspection Procedures to be used at the KSC during the pre-launch and launch activities. These procedures will be coordinated with MSFC S&MA prior to submittal to the KSC Quality Assurance and the Shuttle vehicle Quality Assurance organizations prior to arrival of the AXAF at the KSC. A Memo-of-Understanding will be prepared between the various Quality Assurance organizations to assure a smooth transition of responsibilities during the various phases of the AXAF/Shuttle pre-launch activities.

14.2 PLANNING AND PROCEDURAL CONTROL (512.2)

Quality Assurance will participate in the launch activities, of the AXAF, at the Kennedy Space Center. The activities associated with the launch will be performed with the same rigor and to the same standard of documentation as was provided at the TRW assembly and test facility. Quality data derived from these launch activities will be retained by quality assurance.

APPENDIX A

Appendix A shows the relationship of the TRW Hardware Quality Assurance Manual (HQAM) to NHB 5300.4(1D-2).

NHB5300(1D), CHAPTER 5; QUALITY ASSURANCE CROSS-REFERENCE TO HARDWARE QUALITY ASSURANCE MANUAL

NHB5300.4(1D) PARAGRAPH	HQAM TOC REF.																				
	0.1	0.3	0.5	1.0	1.1	2.1	2.2	2.3	2.4	2.5	2.6	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
500 MANAGEMENT AND PLANNING																					
1. Planning	X																				
2. Organization	X			X	X																
3. Quality Plan																					
4. Quality Controls																					
5. Nondestructive Evaluation																					
6. Management Assessment Data																					
7. Training			X																		
8. Quality Program Audits																					
501 DESIGN AND DEVELOPMENT CONTROLS																					
1. Technical Documents		X			X							X									
2. Quality Support to Design Reviews																					
3. Change Control	X																				
502 IDENTIFICATION AND DATA RETRIEVAL																					
1. General																					
2. Identification and Data Retrieval Requirements																					
3. Identification Methods																					
4. Documentation																					
5. Identification Control																					
6. Record Retrieval																					
7. Retention of Records																					
503 PROCUREMENT																					
1. Procurement Controls																					
2. Selection of Contractor Procurement Sources													X	X				X			
3. Procurement Documents																					
4. Contractor QA Personnel at Source																					
5. Government Source Inspection																					
6. Receiving Inspection																				X	
7. Receiving Records																X					
8. Procurement Source Data																X	X			X	
9. Post-Award Survey of Procurement Source Operations													X	X			X		X		
10. Coordination of Contractor Procurement Source Inspections and Tests																	X	X			
504 FABRICATION CONTROLS																					
1. Fabrication Operations																					
2. Article and Material Controls																					
3. Cleanliness/Contamination Control																					
4. Process Controls																					
5. Workmanship Standards	X																				
6. Control of Temporary Installation																					
505 TESTING, INSPECTIONS, AND EVALUATIONS																					
1. Testing, Inspection, and Evaluation																					
2. Inspection and Test Planning																					
3. Test Specifications																					
4. Inspection and Test Procedures																					
5. Inspection and Test Performance																					
6. Inspection and Test Records & Data																					

NHB5300.4(1D) PARAGRAPH	HQAM TOC REF.																				
	0.1	0.3	0.5	1.0	1.1	2.1	2.2	2.3	2.4	2.5	2.6	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
505 (Con'l) 7. Contractor QA Actions 8. Walk-through/Shakedown Inspection 9. Quality Assurance Designees 10. Vehicle Access Control 11. GSE Access Control 12. Integrity Control																					
506 NONCONFORMING ARTICLES AND MATERIALS 1. Nonconforming Article and Material Control 2. Nonconformance Reporting and Correction 3. Material Review Board 4. Contracting Officer																					
507 METROLOGY 1. Metrology Controls 2. Acceptance 3. Evaluation 4. Article or Material Measurement Processes 5. Calibration Measurement Processes 6. Calibration Controls 7. Environmental Requirements 8. Remedial and Preventive Action						X	X X X X X	X	X X X												
508 STAMP CONTROLS 1. Stamp Control 2. Stamp Restriction																					
509 HANDLING, STORAGE, PRESERVATION, MARKING, LABELING, PACKAGING, PACKING, AND SHIPPING 1. Procedures and Instructions Control 2. Handling 3. Storage 4. Preservation 5. Packaging 6. Packing 7. Marking and Labeling 8. Shipping																					
510 SAMPLING PLANS, STATISTICAL PLANNING AND ANALYSIS 1. Sampling Plans 2. Statistical Analysis																					
511 GOVERNMENT PROPERTY CONTROL 1. Contractor's Responsibility 2. Unsuitable Government Property																					
512 FLIGHT TEST/GROUND OPERATIONS 1. Procedures 2. Planning and Procedural Control 3. Turnaround Inspection and Test Surveillance																					

NHB5300(1D), CHAPTER 5; QUALITY ASSURANCE CROSS-REFERENCE TO HARDWARE QUALITY ASSURANCE MANUAL

NHB5300.4(1D) PARAGRAPH	HQAM TOC REF.																			
	3.10	3.11	3.12	4.2	4.4	4.7	4.8	4.9	4.10	5.1	5.2	5.3	5.4	6.5	7.1	7.2	8.1	9.2	9.5	12.1
505 (Con't)																				
7. Contractor QA Actions					X	X	X											X	X	
8. Walk-through/Shakedown Inspection																				
9. Quality Assurance Designees																				
10. Vehicle Access Control																				
11. GSE Access Control																				
12. Integrity Control																				
506 NONCONFORMING ARTICLES AND MATERIALS																				
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2. Nonconformance Reporting and Correction			X			X	X		X									X	X	
3. Material Review Board			X																X	
4. Contracting Officer																				
507 METROLOGY																				
1. Metrology Controls																				
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3. Evaluation																				
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509 HANDLING, STORAGE, PRESERVATION, MARKING, LABELING, PACKAGING, PACKING, AND SHIPPING																				
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2. Handling																				
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5. Packaging																				X
6. Packing																				
7. Marking and Labeling																				X
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510 SAMPLING PLANS, STATISTICAL PLANNING AND ANALYSIS																				
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2. Statistical Analysis																				
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NHB5300.4(1D) PARAGRAPH	HQAM TOC REF.																		
	12.2	12.3	12.4	12.5	13.1	13.2	13.3	13.4	13.5	13.7	13.8	13.9	14.1	14.2	15.2	15.3	15.4	15.5	16.1
500 MANAGEMENT AND PLANNING																			
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2. Organization																			
3. Quality Plan																			
4. Quality Controls																			
5. Nondestructive Evaluation																			
6. Management Assessment Data																			
7. Training																			
8. Quality Program Audits																			X
501 DESIGN AND DEVELOPMENT CONTROLS																			
1. Technical Documents					X														
2. Quality Support to Design Reviews																			
3. Change Control																			
502 IDENTIFICATION AND DATA RETRIEVAL																			
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2. Identification and Data Retrieval Requirements																			
3. Identification Methods																			
4. Documentation																			
5. Identification Control	X												X						
6. Record Retrieval								X											
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2. Inspection and Test Planning																			
3. Test Specifications																			
4. Inspection and Test Procedures																			
5. Inspection and Test Performance																			
6. Inspection and Test Records & Data													X						

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505 (Con'l) 7. Contractor QA Actions 8. Walk-through/Shakedown Inspection 9. Quality Assurance Designees 10. Vehicle Access Control 11. GSE Access Control 12. Integrity Control																			
506 NONCONFORMING ARTICLES AND MATERIALS 1. Nonconforming Article and Material Control 2. Nonconformance Reporting and Correction 3. Material Review Board 4. Contracting Officer															X	X	X	X	
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4. Quality Controls																				
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7. Receiving Records			X																	
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9. Post-Award Survey of Procurement Source Operations																				
10. Coordination of Contractor Procurement Source Inspections and Tests																				
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2. Article and Material Controls																				
3. Cleanliness/Contamination Control																				
4. Process Controls																				
5. Workmanship Standards					X					X	X	X								
6. Control of Temporary Installation																				
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2. Inspection and Test Planning			X																	
3. Test Specifications																				
4. Inspection and Test Procedures						X	X													
5. Inspection and Test Performance					X	X	X													
6. Inspection and Test Records & Data									X						X			X	X	

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